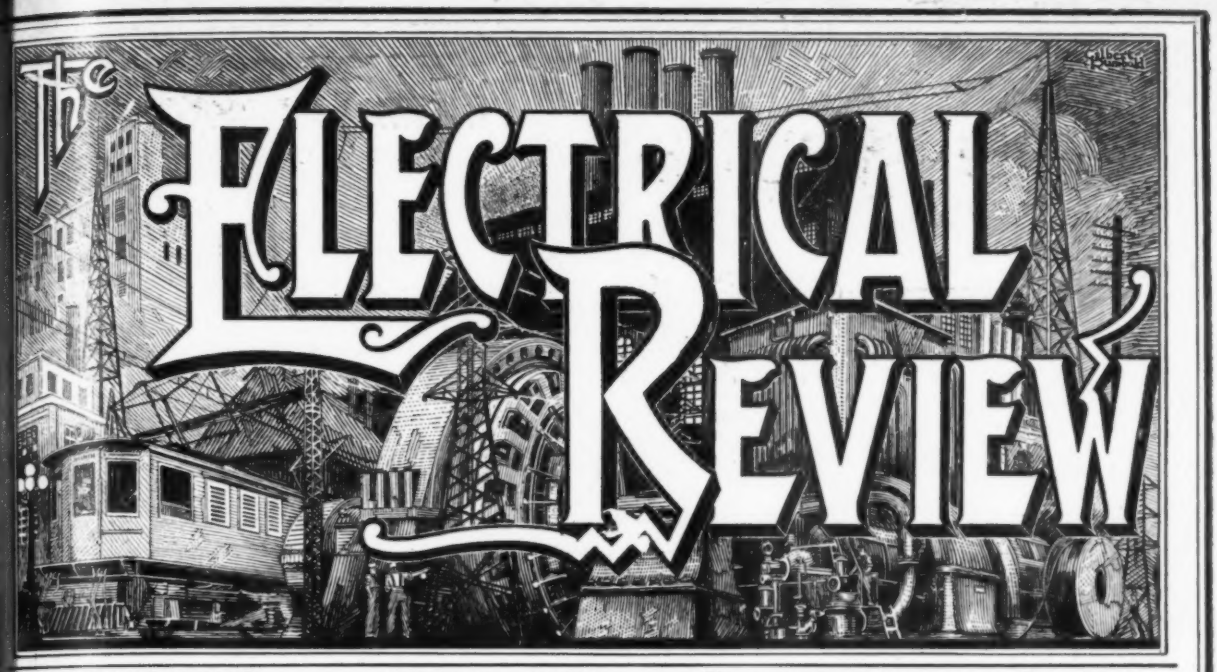

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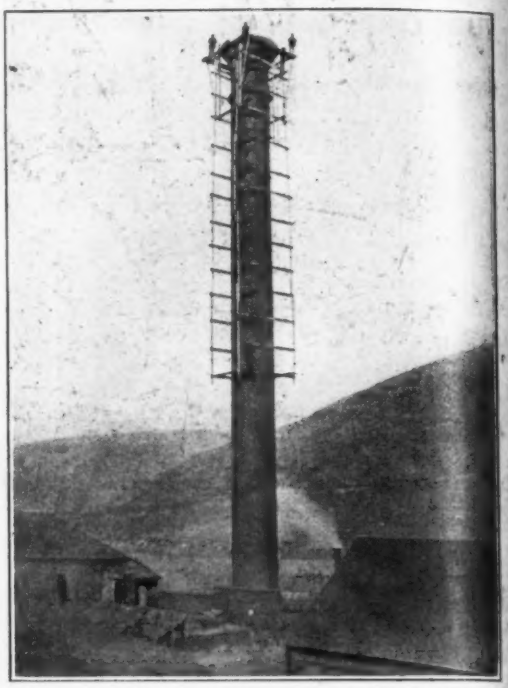

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VOL. XCIII. JULY 27, 1923. No. 2,383.

ELECTRICAL REVIEW.

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THE COPPER POSITION.

COPPER has worked itself by degrees into a very interesting position; opinion here and in America is very sharply divided now as to the probable course of values. The war legacies of enormous accumulations of scrap have been cleared off, also the heavy accumulations in the United States of new refined copper, and work at mines, smelters and refineries, which had been cut down very drastically, has by degrees been restored, until to-day operations are on a normal basis. All these considerations afford evidence of the difficulties of the copper trade in the years following the war, and of the success of the steps taken to restore stability. Alone of the belligerents, America has enjoyed a period of unexampled trade activity, which reached its zenith earlier in the present year. This boom caused the absorption of stocks of all kinds, and very materially assisted in bringing about the marked improvement evident in the copper position, but this trade activity is now waning, and it becomes, therefore, a question as to the probable course of copper values. If production is maintained at its present rate, and America does not continue her consumption as before, there cannot be any doubt as to what will happen. It is remarkable, all things considered, that Europe should have taken as much copper from America during recent years as has been the case, but the growing chaos in Germany, resulting from the Ruhr occupation, is bound to tell, not only upon German consumption, but likely enough upon that of other countries. The effects of the economic disruption of Germany will assuredly not be confined merely to that country, as we here, with our large unemployed total, can testify already. Industrial paralysis in Europe is not a "bull" point for copper.

The mainstay of the market has been, and still is, the electrical industries. All over the world the demand for copper from this group has been insistent, and large schemes are planned, which, if they can be financed, will assure a very big demand for the metal for years to come. From statements furnished by the United States Copper and Brass Research Association, it appears, for instance, that the total expenditure for transmission lines to be erected in America during the current year is $125,000,000, absorbing between 125,000,000 and 200,000,000 lb. of copper for high-voltage transmission lines alone, while the estimated expenditure of $900,000,000 for transmission line construction in the United States during the next five years should afford a market for copper wire and cable of between 900,000,000 and 1,500,000,000 lb. Figures supplied by the Southern California Edison Co., engaged in the world's largest hydro-electric development scheme, show a present use of 26,694,000 lb. of copper in service on its system. On its 60,000-volt transmission lines there are 8,838,000 lb. of copper and on the 30,000-volt lines 740,000 lb. of copper. It is estimated that for 1922 there were 6,000,000 lb. of copper purchased. This company recently completed the first commercially operated 220,000-volt transmission line in the world, and on March 12th began the construction of the largest hydro-electric power house west of Niagara Falls, which, when completed about October 1st, will deliver about 100,000 horse-power.

When all its plans are completed the Southern California Edison Company will have about 35 power houses supply current to about 300 cities and towns. As these generating plants make available from 50,000 to 75,000 horse-power a year, the necessity of building and extending the distributing system of the company throughout the district it serves requires the continuous building of distribution lines for which copper is used almost exclusively. It is, indeed, upon electrical uses that the future of copper prices depends. Statistically, according to inspired American reports, the position of the metal is extraordinarily good, and the fact that further consolidations are planned and proceeding between producers, and between producers and consumers, can only tend to stabilise prices. Important consolidations have already occurred, and those now planned are likely to strengthen considerably the hands of producers in the course of a few months.

The South-Eastern Railway Electrification.

The announcement of the placing of substantial contracts for equipment required for the electrification of the first section of the South-Eastern and Chatham Division of the Southern Railway comes at a very opportune moment. There is, of course, no element of surprise connected with the giving out of this large order, for it has been expected for many months past—the chief interest to electrical men has been who would secure it. But the public, which in its pre-occupation with many affairs soon forgets the projects which its legislators discuss and approve, will be profitably reminded by the event that there is much large electrical manufacturing work to be done within the United Kingdom which need not be deferred by the continued unsettlement in Europe. Relief from the Continental uncertainty is urgently needed so as to release pent-up enterprise all over the world, thus developing foreign trade and increasing activity in our general industries at Home—activity which will yield very large contracts for industrial works electrification. Continental uncertainty is unlikely to defer for long such undertakings as the South-Eastern and Chatham electrification for which millions of pounds have been guaranteed under the Trade Facilities Act. British electrical industry will profit from the placing of the contracts for 508 traction motors of 300 horse-power and the appropriate controlling apparatus with the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd. They are for the operation of multiple-unit trains to serve the suburban lines of the railway company within a 15-mile radius of Charing Cross. The electrical factories of the country have a margin of unoccupied capacity which these and the associated requirements for the same work will help to fill. The speech last week of the President of the Board of Trade with regard to the outlook for new business during the coming half-year was far from encouraging, but so far as electrical employment is concerned, it is to be noted that these two contracts will provide work for some thousands of people during nearly two years. This circumstance alone indicates the importance of railway electrification work to the industry and to the nation. There are many overdue railway electrification works, some of which, in spite of what we have said about the Ruhr situation, would be expedited by general trade revival reflecting increased prosperity for the railways. What we anticipate, however, is the early placing of other orders which are warranted by the need for modernisation of our transportation system. These will do something to fill in the depressions in the curve until works depending upon better financial times are undertaken. We congratulate the English Electric and Metropolitan-Vickers Companies on their success, and wish them and other manufacturing companies more of it, and that at an early date. It is not improbable that the present announcement will have a healthy effect on the Stock Exchange. The *Financial Times*, in referring to the subject editorially, remarks that the contracts now being placed are a good augury for the manufacturers of electrical equipment and appliances. "Many similar orders are now pending from the railways for both suburban and main-line electrification, and it seems that a very prosperous period lies ahead of the industry."

London's Electricity Supply.

Whilst the inquiry with respect to the Draft Order of the Electricity Commissioners is still held up, pending the final decision of the Courts with regard to their powers, some progress has been made towards the settlement of the matter in other quarters. The London Companies having invited the L.C.C. Special Committee on London Electricity Supply to consider the question, a conference has been held between representatives of the Council and of the Companies, regarding which a report appears in the Council minutes, dated July 20th.

The Council has always adhered to the view that any settlement that may be arrived at shall provide for the establishment of a Joint Electricity Authority for a Greater London area, and shall not be confined to the County itself. In conformity with this policy the Committee's representatives drafted proposals for the modification of the Draft Order as a basis of settlement, including an extension of tenure of the Companies' undertakings to 1971, subject to the institution of a satisfactory scale of prices and dividends. According to this scheme, the Companies may amalgamate, and their undertakings will be transferred to the Joint Electricity Authority in 1971— free of cost as regards assets in use when the Authority is formed, and on payment of capital expenditure less depreciation as regards assets subsequently provided by the Companies. A large measure of autonomy will be granted to the Companies, and in view of this their representation on the Authority will be very small.

According to the report, it is understood that the Companies are favourably disposed towards these proposals, which, moreover, do not impair the main principles of the scheme drawn up by the Commissioners, and it is hoped that the latter, as well as the Conference of Local Authorities, will give them their approval.

Undoubtedly it is most desirable—indeed, it is essential to success—that whatever scheme is adopted shall be arrived at by agreement between the various bodies concerned, and we feel that the action of the Special Committee is worthy of high commendation. The matter is one of extreme urgency, and calls for settlement at the earliest possible moment.

Insulation Testing.

In a letter to the *Electrical World*, Mr. Warren Hilleary, superintendent to an insurance company, draws attention to a point in testing the insulation of machines which is often overlooked—the importance of isolating the part under test. His company, which has carried out more than 100,000 tests of insulation resistance during the past two years, has come to the conclusion that such tests are valueless unless the part under test is electrically isolated from the rest of the machine. We take it, of course, that this dictum does not apply to cases in which the insulation resistance of the whole machine in its normal condition is found to be satisfactory. Mr. Hilleary cites instances to show that a low reading of the megger may be due to a trifling matter, such as a defective bushing, or a connecting lead that is too long and touches the frame, eventually making electrical contact therewith; by disconnecting the various electrical components and testing each separately such faults can generally be literally "run to earth" without much trouble and readily removed—a course which is far preferable to sending a machine to the repair shop simply because as a whole it gives a low reading.

SMALL SUPPLIES FROM OVERHEAD TRANSMISSION LINES.

THE growing demand in this country for electricity supply in agricultural and thinly-populated areas, and the proved reliability of the overhead transmission line, have led to a demand for some means of giving a small supply from an e.h.p. line at a cost which will render the supply remunerative both to the supply company and to the consumer.

The cost of a sub-station building of the usual type forms a very large proportion of the total cost of equipment when considering supplies of, say, up to 100 kVA, and it thus becomes necessary to dispense with the sub-station building and to use outdoor gear.

In the construction of small outdoor transformers no great difficulty is met, and the cost does not greatly exceed the cost of indoor transformers of equal capacity, but switchgear of the oil-break type of moderate capacity has not yet been produced at a low cost; and, moreover, the weight of such apparatus prevents its being mounted out of the way on the pole structure, unless this be of special design.

Air-break switchgear for alternating current has the disadvantage that it depends mainly on electromagnetic effect to extinguish the arc formed on breaking load. This effect is at a maximum during the peak of the current wave, and thus the circuit is ruptured very suddenly, and dangerous surges and oscillations may be set up. For this reason oil-break switchgear should always be used on circuits of first importance, and elsewhere when the expense is permissible! Further, when fuses are used on the e.h.p. side of a transformer, they should be graded to operate only on the occurrence of internal faults, and short circuits on the secondary side. Ordinary overloads should be taken care of by the l.p. fuses.

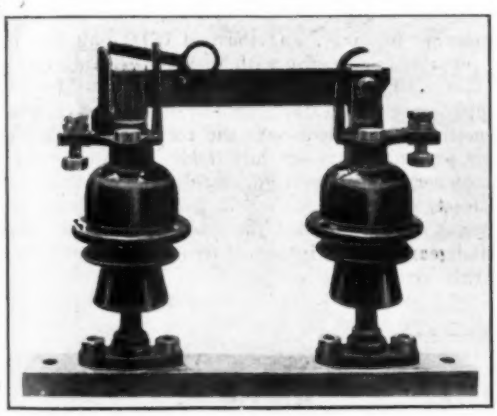


FIG. 1.—AN OUTDOOR ISOLATING SWITCH.
(Johnson & Phillips, Ltd.)

The equipment needed to control the small transformer sub-stations required for rural supplies consists of a switch to isolate the transformer, protection against faults, lightning arrester gear, and the usual l.p. equipment which may be located on the consumer's premises or in a kiosk.

It is usually possible to control the load from the l.p. side of the transformer, in which case an isolating switch of the usual pattern, modified for outdoor use, may be used to break the magnetising current. Such a switch is illustrated in fig. 1, and guides are provided to facilitate closing the blade into the jaws when using a long pole.

Protection against faults may be obtained by means of fuses of various types. The horn-break type, fig. 2, has the fuse wire across arcing horns, the arc formed when the fuse blows being forced up the horns by electromagnetic effect and finally extinguished. This type of fuse needs considerable headroom, and care must be taken in locating such apparatus on a wooden pole to avoid the latter being set on fire should a prolonged arc take place. The fuse illustrated has the working portion detachable by means of tongs, so that the fuse wire may be renewed at the ground level.

The second type of fuse in general use is of the expulsion pattern. This consists of a strong glass tube,

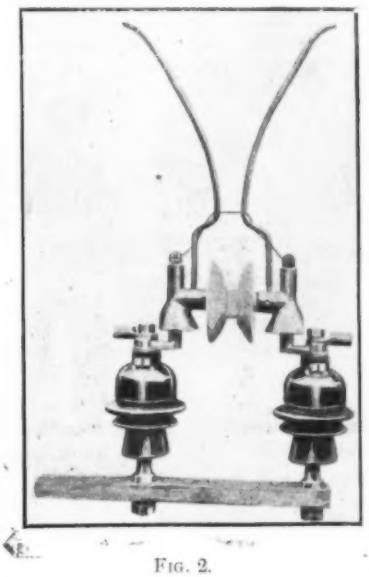


FIG. 3.

FIG. 2.

FIG. 2.—A HORN-BREAK FUSE.
(Johnson & Phillips, Ltd.)

FIG. 3.—"EMPIRE" E.H.P. FUSE, "BLOWN."
(Electric Control, Ltd.)

enclosed at both ends, and provided with contact ferrules. The interior is filled with carbon tetrachloride to assist in quenching the arc, and the fuse wire, which is of short length, is, in the smaller sizes, threaded through a cork, this arrangement increasing the accuracy of the setting. When the fuse operates, a strong spring draws out the arc with great rapidity, oscillograph records showing that the circuit is broken in the first half period. This type of fuse has been used

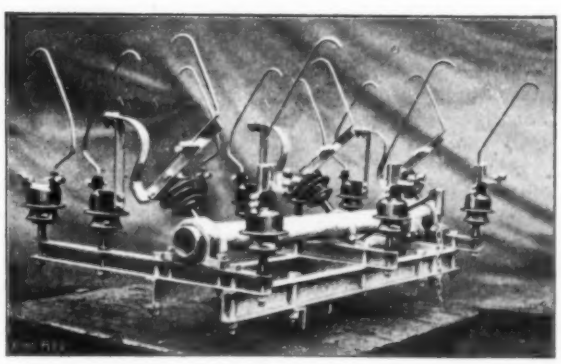


FIG. 4.—A HORN-BREAK SWITCH AND FUSES.
(Johnson & Phillips, Ltd.)

with considerable success to break short-circuits up to 25,000 kVA; where greater power is to be expected, limiting resistances should be used. Fig. 3 shows a fuse of this pattern.

The use of the older pattern of tubular fuse, even for small currents at 3,000 volts, is to be deprecated.

When load has to be broken on the e.h.p. side, some form of horn-break switch must be employed, and fig. 4

illustrates such a switch, mounted together with horn-break fuses, and arranged for operation from the ground level by means of chains. The horns are arranged to make circuit before, and break circuit after, the main contacts, which are thereby protected from damage by arcing.

Another switch of this type, but in this case provided with series overload trip coils, is shown in fig. 5. In this switch the centre portion rotates, giving two breaks per phase. The tripping mechanism is interlocked so

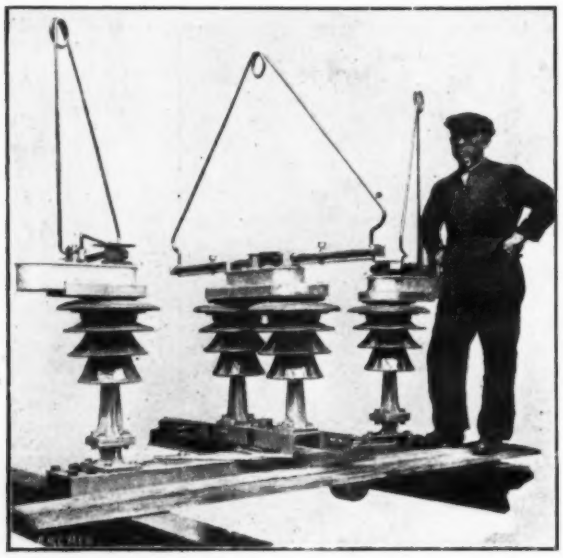


Fig. 5.—An 88,000-Volt Horn-break Circuit Breaker. (Ferguson, Pailin, Ltd.)

that the three single-pole units in a three-phase group operate simultaneously. This switch is designed for operation on an 88,000-volt system, at which pressure fuses are hardly to be recommended. The rupturing capacity of such an air circuit-breaker is probably about 20,000 kVA, although it is difficult to assign a definite figure. A disadvantage attending the use of this type lies in the spacing required between the phases to prevent the possibility of the arc being drawn across the live side of the line, due to the centre horns rotating horizontally.

The lightning-arrester gear employed in equipments of this nature must necessarily be of inexpensive design, and arresters of the horn-gap type are frequently employed. A very compact design, suitable for circuits up to 6,600 volts, is shown in fig. 6. The unit, which comprises a horn gap and series resistance, is designed to clip over the line; the choke coils between the arrester and the apparatus to be protected are not shown.

The value of the limiting resistance used should be

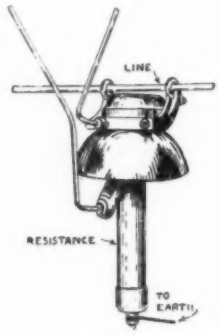


Fig. 6.—A Combined Horn-gap Arrester and Resistance. (Railway & Industrial Engineering Co., U.S.A.)

as low as possible, having regard to the temporary short circuit to be expected when the line current follows the discharge to earth. At the end of a long line it may be possible to dispense with resistances altogether.

The small sizes of power transformers used for isolated supply rely for watertightness on packed joints, and sometimes rain hoods over the terminals. With larger sizes packed joints are unreliable, and the well-known oil conservator type is employed; but in this country, at least, such large sizes will probably only be used in schemes which warrant the use of outdoor oil-break switchgear, a description of which is beyond the scope of this article.

GRINDING COMMUTATORS BY HAND.

The method of grinding commutators by means of a "stone," natural or artificial, applied by hand, is not so largely adopted in this country as in America. Seeing that our proportion of direct-current machines is much greater than that of the Americans, this is remarkable, and may be attributed to one or more of several causes. It is possible that British designs are superior to American, and that, as a result, commutator troubles are less frequent; or it may be that the British attendant is more scrupulous in the matter of cleanliness and attention to such small details as brush-pressure, and so on. The fact remains, however, that we do see, up and down the country, a large number of machines whose commutators are disfigured by flat spots, ridges, high bars of nondescript roughness, any of which defects will eventually lead to the repair shop. We are inclined, therefore, to look for the reason elsewhere, and to suggest that it may consist in lack of knowledge or lack of faith.

Natural stones, which have been tried from time to time, must be selected with the very greatest care, or damage to the commutator will result. The selectors must arrange that the cutting face shall be across the grain of the stone, and every stone must be microscopically examined for foreign veins. With all this care the natural stone has its shortcomings, in particular a tendency to foul or clog with copper, and thus lose its cutting property.

There has recently been brought to our notice an artificial "stone" known as the "Imperial" commutator stone, which, it is claimed, gets rid of flat spots, ridges, &c., more quickly than any other means, removes less copper than a turning tool, and possesses none of the defects of the natural stone.

The "Imperial" stone is composed of a special clay, which is first baked (or vitrified) in an electric furnace, then pulverised, mixed with a suitable binder, moulded to the required size, and baked for 36 hours in a gas furnace.

The pulverising is done in such a way as to leave the particles in a semi-crystalline form with diamond-sharp edges. The secret of the success of the "Imperial" stone lies in this fact and in the composition of the binder. An ordinary grinding wheel tears particles from the surface which is being ground. There are, however, two serious objections to such action on the part of a commutator stone: (1) It would drag the copper at the edges of the bars, and (2) the face of the stone would become clogged with copper, which condition would stop the cutting action, produce a rough commutator, and render unsafe the use of the stone upon a motor operating under its own power.

The "Imperial" stone performs its work differently. The rubbing action between the commutator and the stone frees the cutting particles from the face of the latter, and the cutting is done by these sharp-edged particles, acting between the surface of the stone and

THE STONE IN USE.

that of the commutator. Herein lies the importance of the binder, for it is essential that the cutting particles should be fed in a continuous stream. At the same time, this steady disintegration of the stone at the working face results in a new face being continually presented to the commutator, and thus eliminates the possibility of the stone's becoming clogged with copper.

Amongst the claims made by the makers of the "Imperial" stone are the following:—

That it will (1) cut copper more rapidly than a turning tool.

(2) Save from 80 per cent. to 99 per cent. of the time required to remove an armature and turn the commutator in a lathe. (The consequent saving in cost can only be calculated for the individual job, as it obviously depends largely upon the importance of the work upon which the machine is engaged.)

(3) Grind under full-speed running conditions, when every bar is held in its true operating position by centrifugal force, and leave every bar the correct arc of a perfect circle.

In connection with (2), it should be pointed out that the time and cost involved in turning a commutator sometimes result in the practice of allowing a flat spot to grow wider and deeper until the machine begins to give serious trouble. It is then usually necessary to turn off 1/16th in. to $\frac{1}{8}$ in. of good commutator. Against this the application of a commutator stone, as soon as the flat appears, will remove the defect by grinding off a few thousandths of an inch.

The makers back their claims by a guarantee that if, by the time it is worn out, a stone has not saved at least three times its cost, they will allow full credit and pay postage.

The sole importers to the British Isles are the Electric Construction Co., Ltd., which stocks at Wolverhampton various sizes of stone in grade 2 for commutators, grade 5 for slip rings, and grade 3 for finishing after the use of either.

WIRELESS SERVICE IN PERU.

Marconi Contract in Question—Congress and Company Complain.

[From our Special Correspondent.]

ONE of the first steps taken by the Marconi Company in introducing a perfected radio-service to Peru was the removal of the Lima office staff to more commodious premises, where a complete re-organisation and redistribution of traffic were introduced. A proper system of message-filing, archiving and accounting was adopted in order to bring the service into line with the regulations affecting the International Exchange of Radio-Telegrams laid down by the International Radio-Telegraph Convention, of which Peru is a signatory. The necessary telegraphic and radio-telegraphic station directories were obtained from the International Office at Berne, and distributed to all stations, thus assisting in minimising the risk of loss or non-delivery of telegrams owing to faulty or insufficient addresses. The telegraph lines to San Cristobal and Callao were completely overhauled and reconstructed, new batteries being installed at the Lima office. A telegraph and radio-telegraph school was equipped on the Lima office premises.

The company, under Article 20 of the Agreement (May, 1920), has taken over and maintains the existing Government schools for the training of telegraph operators, both practical and theoretical, providing the pupils with all necessary accommodation, laboratories and apparatus for practical training. All such facilities are available to the Government for the training of soldiers and others in telegraphy, the cost of the training being borne by the Government and refunded to the company. Students, who are members of the messenger and office-staff, have, it is said, shown commendable keenness and enthusiasm in taking up the study of radiography.

Work Carried Out.

The Callao radio station has been completely re-equipped with a modern transmitter and the latest pattern of valve receiving apparatus pending the construction of an entirely new station, which the company proposes to erect in the neighbourhood of Callao, to replace the existing one. This has been found quite inadequate to deal efficiently with the rapid expansion of local radio traffic, not only to ships on the high seas, but to many land-stations up and down the West coast. The extent of the marine work carried out can be gauged from the fact that the Marconi International Marine Communication Company, which was formed with a capital of £1,500,000, has installed apparatus and has conducted wireless telegraph services upon no fewer than 3,000 merchant vessels sailing on all the seas of the world. A station at Cachendo has been equipped with the latest type of valve receiving gear, and this has greatly improved the working. The station, like that at San Cristobal, is now able to receive regularly messages from such distant parts of the world as the United States of America, the Sandwich Islands, Japan and Europe. The Etén and Trujillo stations have been similarly equipped.

Future Projects.

These installations, however, form but part of a much wider project. It was part of the original scheme of the company to erect new lines of telegraph poles from Lima to Trujillo and from Lima to Ica, a few miles back from the sea. Surveys were made and stores ordered, and doubtless the work would have been put in hand and even completed by now, had the Contract of May, 1921, been passed by the Peruvian Congress, and had less opposition been shown by the Peruvian part of the operating

staff. In view of the urgency of the case, and of the systematic sabotage which has often prevailed (discovered when stores have come to hand), the whole scheme had to be revised, and it was decided, with the approval of the Government, to install at once a radio service between Lima and Casma as part of the ordinary telegraph system. The radio circuit works well, so that instead of two uncertain channels for traffic between Lima and Casma, which existed previously to May, 1921, there are now available four channels, all in good working order, which are proving capable of carrying even more traffic than is provided for them.

These stations, together with those at Callao, Pisco, Ilo, &c., have been completely overhauled and inspected by the company's engineers for the purpose. Detailed plans and schedules have been drawn up with a view to re-equipping the stations with the latest type of valve and spark transmitting gear, and embodying them in a comprehensive plan of radio-communication which it has been proposed to extend all over the Republic of Peru with the object of providing a telegraphic network. This, when completed and put into operation, will serve to furnish that State with a thoroughly efficient telegraphic service, equal to any found upon the South American continent. This chain of radio stations has all along been intended to form a trunk system to supplement the existing telegraph system and to supply more rapid communication between Lima and the towns of Etén, Trujillo, Arequipa, Paíta, Chacahapoyas, Casma, Huanuco, Tarna, Ayacucho, Cuzco, Ica and Iquítos.

Relations with other Radio Companies.

The Marconi Company working in Peru had come to an arrangement with the Radio Corporation of America, the Compagnie Télégraphie-sans-Fils, of Paris, and the Telefunken Company, of Berlin, to erect a series of high-power wireless telegraph stations. One is already in course of construction at Buenos Aires (Argentina), and this should be ready for service about May 1st, 1924. In Rio de Janeiro (Brazil), and elsewhere in the Republic, similar work has been commenced. At Bogotá (Colombia), a station was opened quite recently, and other arrangements are in course of negotiation with the object of enabling the various South and Central American Republics to communicate by wireless with Europe and the United States, and, in fact, with any part of the world.

The sole and exclusive usufruct of the Peruvian wireless stations and services together with the full, free and exclusive right and licence to erect any further wireless telegraph station or stations thought necessary is vested in the Marconi Co., which is entitled to use and exploit all future patents in any way, free of any control. Such stations and services are to be directed, manned and operated by the company whose undertakings will be in all respects separate, free and independent of the State Postal and Telegraphic Services. The company undertakes, after a reasonable term as from the 1st May, 1921, to keep at all times a radio-telegraphic station of sufficient power to communicate directly (receiving and transmitting) with Marconi system stations working in South America. For this purpose the company undertook to establish a new wireless telegraph station or to transform any of the existing stations to render this service. At the expiration of the agreement (which was to have a life of 25 years), the Peruvian Government would become possessed of the wireless telegraph stations and service, previously paying to the company the value of the new stations and the value of improvements made in existing ones. These values would be mutually agreed upon between the parties, or, in default of agreement, some independent valuer would be mutually agreed upon. In any case, the valuation would take into consideration not only the intrinsic and commercial value of the stations but also the revenue derived from them at the time of the transfer.

Will the Contract be Completed?

There seems to be some doubt now whether the Marconi agreement will, after all, be ratified by Congress. Agitation against the company because of its foreign origin has been very rife for a considerable time past, but in the Senate the contract was approved with less opposition. The company, in any case, is believed to object to the contract as it stands, and will insist upon certain alterations. The whole question will be finally gone into in a few days, Congress having been summoned to meet on the 28th inst.

SPECIFICATIONS.

BY A CONTRACTOR'S ESTIMATOR.

Truly, a contractor's estimator leads a dog's life.

I have a grievance—in fact I have been collecting grievances for years. They are called architects' specifications, and I have one of the finest collections of specimens in England. If any architect thinks he has found a really original clause, calculated to confuse an electrical contractor, may I beg him to send it to enrich my collection? I will willingly give him an estimate in exchange. But I mustn't forget my latest specimen grievance—arrived this morning— a job for which a competitive estimate is required without delay.

With an optimism which probably accounts for my peculiar profession, I noticed at once that the specification was prepared by a man calling himself a "Borough Engineer and Surveyor." Architects' specifications do tend to wear one down in time with their paucity of information and misleading phrases. Now this man appears to have taken some trouble over his work. There are eight closely typed sheets of information, and plans too. It seems too good to be true. Instead of having to measure and guess and take chances here, there and everywhere, I shall have complete information ready to hand. Without doubt, an engineer and a gentleman.

Now for the specification.

The heading shows that it describes the electric lighting of an isolation hospital, and the plans show that the hospital buildings lie dotted about on large private grounds. Of course, the opening paragraphs explain that the contractor must make provision for supplying all material specified and all labour involved. Very right and proper. Then there is a good deal of information about the steps the contractor must take to insure his workmen. He must provide necessary tools, steps, scaffolding and tarpaulins. (Jimmy, here is a job that requires tarpaulins. Run and see if we have any handy.) He mustn't forget to include for carriage, packing, fixing *and profit* (generous fellow), and for complying with the Institution Rules. He must remove his ladders after completion of the work. The contractor must include in his estimate for compensation to any animal, person, adjoining premises or vehicle damaged during the progress of the work. (It looks as if the man would be a good thrower who could hit an adjoining property from the site of the work.) He must carry out his work to the satisfaction of the surveyor. In fact, there are seven and a half pages describing the perfections expected of the contractor who will be fortunate enough to secure the job, and only the last two paragraphs refer to the work itself. They are in these words:—

> "The contractor to execute all work shown on the plan, whether specified or not. Lamps and fittings are specified in schedule attached hereto."

That's all, except the schedule, which is a list of rooms with the number of pendants, wall plugs and heating plugs required in each. The plan is as much a disappointment as the specification, as it is unscaled and hasn't a mark on it to indicate the position of any electrical work at all. No lamps are mentioned in the schedule. No information is given about the system of wiring required. The schedule refers to eight "power plugs," but the contractor is left to guess if they are for small fans or for heavy duty heating. Were they not endorsed "Plans and Specifications for the Electric Lighting of the Isolation Hospital," it is doubtful if one could tell these papers from an Act of Parliament or a complicated form of lease.

Now this article would never have been written if the grievance served out by the engineer and surveyor were unique or peculiar. One would just say: "Poor fellow —I wonder how such folk get their jobs," and leave the matter there. But that, unfortunately, is far from being the case. It is as uncommon to find—in the Provinces at any rate—a specification for electric wiring prepared by a man with any practical knowledge of the work as it is to find a canine vegetarian.

It is well known that architects always, and consulting engineers usually, leave the preparation of wiring specifications to their youngest pupil. Well do I remember the first specification I ever prepared. In the days when I was earning less than 10s. a week I was given architects' plans, a little book of "wiring rules" and a specification for a boiler plant on which to model my phraseology, and left to get on with the job. In due course an advertisement announced that "Tenders are invited for —. Plans and specifications may be obtained for a deposit of £2 2s.," and without correction or alteration the specifications so prepared were issued. (At any rate, both the scale and the positions of lights were on those plans.)

Much water has passed under London Bridge since then, but still the same customs prevail and estimators have grown so used to them that they have almost ceased to grumble. One I know, grown old in the job, says "'Tis a matter of experience. I just look over a building and know how much it will cost, and if I charge too little on one job I even it up on the next." Well, I dare say that under existing circumstances he is right, but 'tis a situation which does little credit to the electrical industry as a whole, and the E.C.A. might devote a profitable hour or so to drawing up model forms of specification to which alone contractors should consent to tender.

THE CHEMICAL AND PHYSICAL PROPERTIES OF INSULATING OILS.

Report on B.E.A.I.R.A. Research.

It will be remembered that accounts of the preliminary work on the above subject have been published in various journals. The present report, which we abstract from the June issue of the I.E.E. *Journal*, embraces the most important details of the present investigations. It is pointed out that with a view to extending the sources of supply of insulating oils, and especially the utilisation of possible sources in the British Isles, inquiries have been made into the possibilities of coal tar distillation by-products and of shale oils as sources of insulating oils. It has been concluded that there are no immediate prospects of assistance in these directions, but the matter will not be lost sight of.

Change of colour on heating has been employed on the Continent as an indication of sludging characteristics, but after thorough investigation it is concluded that this method of testing could not be employed as a substitute for methods recommended, and that colour cannot be taken *per se* as giving any indication of the sludging characteristics of an oil.

Based on the information supplied by the British Electrical and Allied Industries Research Association, a British standard specification for insulating oils for use in transformers, oil switches and circuit breakers (No. 148—1923) has been issued by the British Engineering Standards Association. The specification will be revised and added to from time to time as the results of further investigations come to hand.

The main cause of trouble from oil in transformers can be traced to the presence of air which, under the action of heat and accelerated by contact with certain metals, oxidises and polymerises the oil, with the result that solid deposits are formed which settle on the windings and result in overheating. At the same time water and organic acids may form, which reduce the electric strength of the oil and may attack the materials of the transformer and casing. During a period of seven years one of the investigators heated a sample of transformer oil to a temperature of 150 deg. C. for over 14,000 hours, air being excluded. There was no perceptible alteration in the oil, no formation of acids, no water and no deposits.

All transformer oils would not give as good a result as this, even if air were excluded, as many of the poorly refined oils have a certain proportion of oxygen in their composition. It is probably not possible to exclude air from all transformers and it was therefore necessary to standardise a test which would give not only an indication of the tendency of the various oils to deposit solid matter, but also a measure of their liability to form water and organic acids.

The prime object of the research on sludging was to ascertain by a series of tests carried out by different laboratories upon one and the same set of oils and using a selected method of test, whether a sludging test was suitable for standardisation for purchasing specifications of insulating oils.

The oils tested represented three sources, *viz.*, East Asiatic (Burmah), West Asiatic (Russian), and North American (U.S.A.). The results indicated that the pale Russian oils were the best, but some American modern refineries have produced an American oil of equal merit under this form of test. In all cases, both with oxygen and with air, the oil darkened in colour, the darkening increasing as the temperature was raised. The deposits which separated out were also darker in colour with the higher temperature.

In every case where air was used the deposits were in the form of powders, while with oxygen sticky varnish-like substances were usually obtained. The Association recommended that air be used in the standard method for specification purposes, that is, the original form of the test devised by Dr. Michie with modified apparatus.

The Kissling test is used to a large extent on the Continent, and especially in Germany. It is a measure of the tar content of some of the acid compounds formed by the oxygen used, others being driven off at the high temperature. The material obtained by this test is small and would not precipitate in a transformer. The test does not take into account the catalytic action of copper. It is considered that there is no connection between the tar value as given by the Kissling test and the sludge formed in a transformer. Some of the best oils give high Kissling values but practically no sludge.

Tintometric determination of the colour of oils before and after sludging showed that there did not appear to be any direct indication of the commencement of sludging by colour-change, and the colour-change appeared to be gradual.

Colour/temperature curves for a definite stratum thickness indicate that the colour number increases slowly at first, but as the temperature is raised the increase becomes more rapid. For the better oils the change takes place at 90 deg. C., while for those which deposit sludge the change appears to be at from 60 to 70 deg. C. This appears to be the clearest indication of sludging tendency given by the curves.

The presence of sludge in the oil does not appear to exercise any appreciable influence on the colour number.

The tests proved that this method was greatly influenced by the personal equation, and it was concluded that colour tests could not be relied upon as criteria of the sludging characteristics of an oil.

With regard to the significance of the evaporation tests, they afford a measure of the economy of the oil in use, and also of the safety of the oil, *i.e.*, they show whether dangerous quantities of vapour are evolved which (having a flash point of from 130 to 185 deg. C.) could produce large-scale explosions if mixed with air and ignited. It should be particularly noted that the evaporation does not afford any indication of the dryness of the oil, and cannot be made to do so with any really satisfactory result.

Results of the acidity and alkalinity tests proved that these oils were pure and free from injurious quantities of either acids or alkalis. These two tests are of a purely precautionary value. Normally there should be no reaction, and even in old stock the reactions should not show more than the equivalent of 2 or 3 mg. of caustic potash (KOH) per gramme of oil. To prevent imperfectly purified oils being used, these

tests are proposed as part of all specifications. They also form checks upon the behaviour of the oils during use, because they will indicate whether (i) the sludging is producing undesirable amounts of acidity, and the rate of its formation, or (ii) if the oil is dissolving acid-resinous and free-acid bodies from insulations or paints which have been used in the construction of the apparatus.

There is a distinct practical and chemical relationship between the iodine value of an oil and its sludging propensity under commercial conditions of use. The relation is far more clearly traced when the sludging has been performed when using air than when employing oxygen. This test is of value as providing an alternative rough check of oil deliveries with respect to their sludging qualities. The iodine value can be determined by the Hübl method in from 18 to 24 hours, as against from 72 to 80 hours for the completion of the sludging test (*i.e.*, before the weight of the separated and dried sludge can be obtained).

The general form of the vapour pressure curves is that usually found for such pressures, increasing slowly at first and with greater rapidity at higher temperatures. In no case is the vapour pressure at 150 deg. C. greater than about 70 mm. mercury (less than 1/10th atmospheric pressure) so that, for example, the pressure at 150 deg. C. in an enclosed space containing oil would be only 1½ lb. per sq. in. above atmospheric pressure.

In connection with the action on insulating oils of those metals and catalysers which are commonly used or may reasonably be expected to be used in the construction of oil switches and transformers, it was known that the character of the sludge varied with the catalyser, that some metals have a serious effect on the amount of sludging, and that under certain conditions, not yet analysed, the sludge produced may have a bad effect on a switch.

The action on oils of 17 different materials was tried. In all cases the oil darkened in colour, the darkening being roughly proportional to the amount of deposit formed. Of the metals, precipitated copper was the most active, then lead and strip copper and the copper alloys. The other metals showed practically no action on any of the oils. Of the other materials used, litharge showed a very pronounced action. In all cases the deposits were of a powdery nature, with one exception, where the deposits were of a sticky nature.

It was concluded that dryers containing lead or cobalt, or manganese resinates or acetates, are liable to increase the quantity of sludge formed by an oil. For this reason paints or varnishes containing these dryers should be reduced to a minimum if employed at all.

Other researches are in hand.

PARLIAMENTARY NOTES.

(By our Special Parliamentary Reporter.)

Royal Assent.—The Royal Assent has been given to the Oakham Gas and Electricity Bill; and the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Bill.

Tramway Charges.—On July 16th, during the debate on the Expiring Laws Continuance Bill, Capt. Berkeley moved to omit from the scope of the Bill that part of the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, which empowers tramway undertakings to increase their charges by 50 per cent. He asked why this concession should be made to tramway undertakings and not to other undertakings of a similar character.

Col. ASHLEY, Parliamentary Secretary to the Ministry of Transport, said the other allied undertakings, such as gas, water, and electricity, had already been provided for. Gas was provided for by power given to the President of the Board of Trade, water by the Ministry of Health, and electricity was regulated by the Electricity Commissioners. There must be some way by which a tramway undertaking was allowed to make both ends meet. At the present time increases could be given by the Ministry of Transport up to March 31st, 1924, and what was proposed under the Bill was to continue this provision up to December 31st, 1924.

The amendment was negatived.

Imperial Wireless Chain.—On July 17th, the Postmaster-General, in answer to Sir H. BRITTAIN, stated that the Post Office had purchased 800 acres of land near Rugby for a high-power station as a link in the Imperial chain. The cost of the site, including compensation for disturbance, would be about £50,000. Provision had been made by the Governments of Australia, South Africa and Canada for the erection of stations for communication with this country, but so far as he was aware no definite arrangements had been made in India and New Zealand. In some at least of these cases express provision had been or would be made for the stations to communicate with stations of the Imperial system generally. But the question with what distant stations the new Government stations here should communicate was at present a subject of negotiation.

Mr. BECKER asked the Postmaster-General if he would state the name of the company which had applied for a licence to build a high-powered radio station in this country in connection with the Empire chain; would this company have the same chances of obtaining a licence as the Marconi Co., or would a certain preference be shown to the latter company owing to its having held previous licences?

Sir L. WORTHINGTON-EVANS said the company in question was the Eastern Telegraph Co. It would have the same chances of obtaining a licence as the Marconi Co. so far as the Government was concerned. The question of corresponding stations in India or the Dominions would be one for the Governments concerned.

Tooting Tramways.—On July 18th, Mr. EDE asked the Parliamentary Secretary to the Ministry of Transport if he was aware that the London County Council tramway service at Tooting Junction and the service connecting Tooting Junction and Croydon came within a few yards of one another but did not connect, thereby preventing the running of through cars from London to Mitcham and Croydon by the Tooting Junction route; and whether, in view of the inconvenience caused to the public by this he would suggest to all the parties and authorities concerned that the two services should be connected.

Colonel ASHLEY said he understood that the matter was at present under discussion between the tramway authorities concerned and that it was hoped that it would be possible to arrive at some arrangement under which through services would be run between London and Mitcham.

The Rutenberg Concession.—On July 23rd, Mr. BECKER asked the Under Secretary of State for the Colonies if, seeing that the use by the Rutenburg Co. in Palestine of oil engines for producing the energy to develop electricity was a breach of its monopoly agreement, he would inquire into the matter and, if necessary, cancel the concessions.

Mr. ORMSBY GORE said he was not aware that any breach of agreement had taken place. He did not think it possible or necessary to take the action suggested in the last part of the question.

Radio-Telegraphy.—On July 23rd, Mr. SMEDLEY CROOKE asked the Postmaster-General whether his attention had been called to a proposal of the Italian Government for an international conference under the auspices of the League of Nations to consider the whole question of telegraphy and radio-telegraphy; and whether it was the intention of the Government, in view of the importance to British trade of the improvement and extension of all forms of communication, to associate itself with this movement and to notify the Council of the League of its willingness to co-operate.

The POSTMASTER-GENERAL said that the proposal was considered last week by a conference of French, Italian and British specialists held under the auspices of the League of Nations. In view of the proposals which had already been made by the French Government for the summoning of a general international conference to cover the same ground, it was decided to postpone action until October, with a view to ascertaining whether there then appeared to be a reasonable prospect of the conference contemplated by the French Government being held in the first half of next year. If not, the French, Italian and British specialists would meet again in order to consider what action should be taken on the Italian proposals.

A Legal Point.—On July 23rd, Mr. LEACH asked the Postmaster-General if his attention has been directed to the result of the test case between his Department and the Liverpool Corporation, in which it was held that Post Office wires laid in close contiguity to Corporation electric cables by his department were so laid at his department's risk with regard to possible damage; and whether a claim for damages under precisely similar circumstances against the Bradford Corporation of £59 9s. 3d., and paid by it under protest, would be refunded.

SIR L. WORTHINGTON-EVANS said that the answer to the first portion of the question was in the affirmative. As regarded the second part a claim from the Bradford Corporation for refundment was receiving careful consideration, but he could not admit that the circumstances of the two cases were similar.

The Public Works, &c., Congress and Exhibition.—The King is patron of the Public Works, Roads, and Transport Congress and Exhibition, which is to be held at the Agricultural Hall from November 22nd to 29th. The arrangements are in the hands of the Congress organising committee, of which Sir Henry P. Maybury, K.C.M.G., Director-General of Roads, is chairman. The committee is composed of representatives of the Ministry of Health (*ex-officio*) and all the principal associations of local authorities, public bodies, and their officials. Practically the whole of the exhibition space has already been booked by firms specialising in materials, machinery, plant, and vehicles used in connection with public works and municipal undertakings.

LEGAL.

Dunn v. Payton.

AT Cheltenham County Court on July 13th, before Judge Macpherson, Albert E. Dunn, electrical engineer, sued Henry H. Payton for £92, being the value of articles belonging to the plaintiff, wrongfully detained by the defendant, damages for their detention, rent, and money said to have been collected by defendant on plaintiff's behalf. Defendant counterclaimed £21 wages overpaid under an employment agreement, a sum of £17 said to have been received by the plaintiff for the use of defendant, moneys alleged to have been wrongfully converted by the plaintiff (£9), and £29 value and £5 damages for goods detained by the plaintiff, amounting in all to £82. In his evidence plaintiff spoke of a profit-sharing agreement with the defendant which was broken off at an early stage. Defendant wished to take away certain goods which he had bought at a sale, and plaintiff agreed to this. He alleged, however, that defendant commenced to take everything away, and he interfered. Defendant stated that he only removed goods which belonged to him and for which he had paid £200.

After hearing the evidence, the JUDGE said that he was prepared to make a rough estimate of the value of the goods, or it could be left for decision with the Registrar or other person. Plaintiff's solicitor agreed that the Judge should decide, but defendant's solicitor elected to follow the other course, and finally the Judge adjourned the case until September 14th in order that a valuation might be made. An interim injunction which had been obtained by plaintiff to restrain the defendant from parting with the goods would be continued unless and until the defendant paid £50 into Court.

Palmer v. General Electric Co., Ltd.

IN an action before Mr. Justice Salter and a special jury, in the King's Bench Division, on July 20th, judgment was given against the defendant company for £1,300 in respect of a collision between one of its cars and a motor cycle and side-car.

The accident occurred on the London Road, at Bushey, on August 14th, 1922. The motor-car, in an endeavour to avoid a cyclist who had fallen from his machine in front, swerved to the off side of the road and collided with the motor-cycle and side-car driven by the plaintiff, Arthur Edgar Palmer, of Shepherd's Bush. The plaintiff's wife and child were riding in the side-car. The plaintiff's leg was crushed and had to be amputated below the knee, Mrs. Palmer was badly bruised and shaken, and the child sustained a broken thigh. Mr. Palmer was awarded £1,200 damages, and his wife and child £50 each, with costs.

B.T.H. Lamp Patents.

JUDGMENT was given by Lord Blackburn, in the Court of Session, Edinburgh, on July 19th, in the action of interdict at the instance of the British Thomson-Houston Co., Ltd., against Charlesworth, Peebles & Co., mechanical and electrical engineers and merchants, Glasgow, and for £10,000 as damages, for the infringement by the defenders of a patent dated 1909, of which the pursuers were grantees. The infringement consisted of the importation and sale by the defenders of incandescent lamps containing a filament of tungsten made in the manner described in the patent.

Lord Blackburn sustained the validity of the patent, granted interdict and expenses, and continued the case for proof on the question of damages, and granted leave to reclaim. He said that most of the pleas usual in a case of this kind were stated for the defenders on record, but eventually the case as presented for them resolved itself into a challenge of the validity of the patent on the grounds of anticipation, want of subject-matter, and insufficiency of description, and a denial that infringement had been proved.

Having examined the claims made in the patent, Lord Blackburn described the process by which, as the result of repeated working, the tungsten was changed from a crystalline to a fibrous structure, which made it ductile or capable of being drawn, and differing radically from any form of tungsten previously obtained. If it were, as it was proved in this case to be, that the product was one which had for long defeated all endeavour to produce it, then it appeared to his Lordship to follow almost inevitably that the process by which it was produced must merit the description of novelty as much as did the product itself. It was only the ingenuity of the inventor which had enabled him to surmount the obstacles which presented themselves to others, and had met a long unsatisfied want. Continuing, his Lordship said that the conclusion he had come to was that the pursuers had succeeded in establishing the validity of the patent so far as related to Claims 1 to 4 which they made. With regard to Claim 5, which was for apparatus, had it not been qualified by the words "for manufacturing wires or filaments of tungsten ductile at ordinary temperature," he did not think he could have sustained it. But qualified and restricted as it was, it appeared to him to be unobjectionable. There remained only the question of infringement. It was maintained that the pursuers had failed to prove that the filaments complained of had been constructed in accordance with the directions in the patent. The evidence for the pursuers was confined to this, that they had proved that the filaments in the lamps sold by the defendants were fibrous, and they maintained that there was no other known process by which such a product could be obtained than that set out in their patent. The pursuers' evidence was certainly not more than sufficient to establish a *prima facie* case of infringement, and, had the lamps been manufactured in this country, that would not have been sufficient to entitle them to decree. But the lamps here complained of were manufactured abroad, and accordingly this *prima facie* evidence of infringement was sufficient to throw the onus on the defenders of proving that they were not manufactured in accordance with the process described in the patent. In his Lordship's opinion, the defenders had failed to discharge that onus.

Alleged Power Station Nuisance.

AT the Chancery Court, in Douglas, I.O.M., on July 18th, several suits were entered by property owners in the neighbourhood of the Douglas electric power station against the Mayor, Aldermen and Burgesses of the Borough of Douglas for injunctions to stop the nuisance and injury to their property by reason of the noise and vibration of the machinery.

Castle Rubber Co., Ltd., v. The Radio Engineering Co., Ltd.

AT the Warrington County Court on July 19th, plaintiffs sued defendants, of London, for £31 9s. 4d., the value of sheet ebonite supplied to their order. Defendants counter-claimed £18 8s., the cost of machining the ebonite, which was alleged to have been of a lower quality than samples submitted.

Plaintiffs contended that as the defendants had retained the ebonite in their possession for a period of six weeks before intimating to the plaintiffs their intention of rejecting the material, they had no right to reject the goods. It was also contended that at the time of the purchase of the ebonite the defendant company did not make known to the sellers the purpose for which they required it. It was ebonite of the cheapest grade, and defendants must have known that it could not produce the best results.

For the defendant company, Mr. J. GREENWOOD said it was impossible to detect the foreign matter in the ebonite until it was cut up. The material was not in accordance with the sample. The defects were not apparent until they came to cut it up. The counter-claim was for the costs incurred in working it before the defects were discovered. Immediately after the discovery the ebonite was tested electrically and it broke down. It was for parts of wireless apparatus on big ships and wireless stations.

Mr. R. E. BESWICK, manager of the Radio Communications Co., Ltd., said he was an electrical engineer, and had had considerable experience of the manufacture and use of ebonite. The material supplied by the plaintiff was totally useless for wireless purposes. His attention was drawn to a statement by a witness for the plaintiff company that they had sold a large quantity of ebonite of similar quality, of which they had had no complaint; witness said the bulk of the material went to factors, who did not machine it to any great extent, but sold it to amateurs, who had only few tools, and no voice to complain.

In giving judgment for the plaintiff company on both the claim and the counter-claim with costs, his Honour said he held that the plaintiffs were totally unaware for what purpose the ebonite was required; that there had been a lapse of a reasonable time before any complaint was made, and that the goods were accepted.

Thefts of Electricity.

AT the Moot Hall Police Court, Newcastle-on-Tyne, on July 18th, five men—one miner and four labourers—were charged with having fraudulently extracted electricity from the mains of the Newcastle-on-Tyne and District Electric Lighting Co. between January and June. The accused pleaded guilty.

Mr. F. E. FORSTER, solicitor, prosecuting, said that for some time past the company had been aware of a considerable leakage in the Newburn district, in which the men charged resided. There had been established a sort of warning, for when an inspector of the company made his appearance in the district to test the penny-in-the-slot meters, the fact was communicated, and steps taken to make all the meters in order. The method by which the current was taken consisted of inserting an ordinary pin into the ingoing cable to the meter, and another into the cable beyond the meter, the two being connected by a length of insulated copper wire, so that the current was taken without passing through the meter. Inspectors of the company proved finding appliances such as had been described, which they produced.

The accused were fined £3 each, or a month's imprisonment in default.

Asked by the chairman of the magistrates whether means could not be devised to prevent tapping, Mr. Forster said steps were now being taken to that end.

Charged with extracting electricity from a main without its passing through the meter, William Howells, electrician, Skewen, was fined £2 at Neath Police Court.

REVIEWS.

The Prevention of Vibration and Noise. By ALEC B. EASON, M.A. (Cantab.), A.M.I.C.E., A.M.I.E.E. Pp. xii+163; figs. 65. London: Henry Froude and Hodder & Stoughton. Price 15s. net.

The problem of preventing noise and vibration is of particular importance to the electrical engineer because it so frequently happens that electrical machinery is found in private dwellings or in power houses situated in residential districts. The author, who has contributed articles upon this subject to the columns of the ELECTRICAL REVIEW, confesses that he was led to the compilation of this book after he had been collecting various information upon methods of preventing vibration, caused by an unbalanced electric motor-generator, from being a nuisance to inhabitants of the building in which it was situated.

The information which is available upon the subject is very wide and varied, but hitherto it has been scattered throughout the technical publications and the proceedings of the scientific and technical institutions throughout the world. In endeavouring to collate these data, the author has performed a task which should prove of very great value. The bibliography which he gives covering both books and periodicals serves to indicate the extent of his search, and will also enable the interested student to study in greater detail any particular phase of the subject in which he is interested.

The problem of vibration, with its natural concomitant noise can be attacked in two directions: first, by eliminating or isolating the effects of vibration, and secondly, by so designing or modifying the machinery that it shall not be subject to vibration. It is not, of course, always possible to obtain machinery that is so perfectly balanced that it runs entirely free from vibration, and under these circumstances the problem must be attacked in the first way. Thus where small reciprocating engines such as gas or petrol engines are employed to drive electrical generators it is practically impossible to obtain so perfect a balance that vibration is absent. There are, however, certain well defined methods whereby these vibrations may be confined to the locality of the room in which the engine is running, and these are set forth in the book under review with considerable detail. Again, with rotary machinery, such as electric motors and motor-generators, while theoretically it is possible so to design them that the balance is perfect, in practice, particularly when they are rotating at high speed, the amount of vibration and noise which they cause may be very great indeed. The problem of minimising the effect of vibration in such cases as these is thoroughly dealt with, particularly with regard to the use of motor-generators in telephone exchanges.

The ideal method of dealing with the problem is so to design the machinery that even when running at the highest speeds, vibration shall be absent. The modern tendency is all in the direction of using high-speed rotary machinery, and by the use of delicate balancing apparatus it should be possible to obtain a more or less perfect balance before the machine leaves the shops. Various methods have been devised for determining the amount of out-of-balance force in a rotor, and the position at which it acts both when the rotor is at rest as well as when it is in motion, and in his concluding chapter the author describes the different forms of static and dynamic balancing machines that are available. In accordance with the principle that prevention is better than cure, this is one of the most important sections of the book and for itself should commend the book to all electrical engineers. But with the rapid development of the use of the electric motor for both industrial and domestic purposes and the use of high-speed rotary machinery generally, the twin problems of vibration and noise become of increasing importance, and as indicating the progress which has been made in the direction of eliminating these, this book is to be highly recommended.

The Electrical Handling of Materials. By H. H. BROUGHTON, M.I.Mech.E., M.I.E.E., &c. Pp. xx+334; figs. 279. London: Ernest Benn, Ltd., 8, Bouverie Street, E.C.4. Price 50s. net.

This is the fourth volume of "The Electrical Handling of Materials," the first three volumes of which we have already noticed in these columns, and the present volume completes the set. Vol. 1 deals with "Electrical Equipment"; Vol. 2, "Structural Steelwork and Mechanical Equipment"; Vol. 3 with "Cranes and Crane Mechanism"; and the present volume with "Machinery and Methods," which in itself is a voluminous subject. The author, however, has made an excellent selection of examples of the very many types of machinery, including elevators, conveyors, hoists, &c., and the methods of handling, storing and reloading bulk material, such as coal, grain, &c.; in fact, to go through this book and look at the many illustrations of the various plant, from the small portable conveyor—for dealing with small parcels—to the huge installations of plant for dealing with coal storage and coal handling, makes one really wonder at their marvellous construction. We disagree, however, with the author to some extent in his seeming preference for American and Continental examples, and his statement that "the United States easily leads the world in the production of steel" might be seriously questioned; we feel quite sure that some of our own steel works can beat the American in producing and handling steel products in cost per ton, if not in quantity. But for "bigness" we agree with the author that we must go to America, and we consider he has done a service to engineers in this country in so ably describing and illustrating the various plants.

The book contains some 334 pages divided into twelve chapters, illustrated with 279 drawings or photographs of examples and details of plant and machinery, taken from all parts of the world. We know of no book on this subject which so thoroughly deals with it and we congratulate the author on the conclusion of the work, which must have involved an immense amount of labour, for which we trust he will receive the credit and reward he so richly deserves.

Dictionary of Applied Physics, Vol IV: *Light, Sound, Radiology.* Pp. viii+914; illustrated. London: MacMillan & Co. Price 63s. net.

For a practical electrician and busy man this is a dangerous book to pick up. Being a practical man he may be expected to have some utilitarian object in view in handling the volume, and if he harbours any other interests whatever, of scientific affinities, it will go hard, but he will find himself lost in the perusal of a fascinating article, without financial meaning, on some subject that has no bearing on any commercial end of his seeking. If, for example, he have an ear and mind for music, instrumental or otherwise, it will be difficult for him to pass over the pages treating of acoustics without faltering, lingering, and finally stopping by the way. We say nothing of the quantum theory, admirably dealt with, because that may be regarded as having some commercial potentialities in the future, however remote; but glass-grinding, periscopes, sound-ranging, kinematography, are so many snares to the feet of the unwary. If he be obliged to refer to the book, the only safe means for a practical man with his living to make to adopt is to request his typewriteress to find him the passage he requires, and to hand him the book with a marker between the leaves he must look at, so that he need see no other.

In spite of these drawbacks, or rather because of them, this fourth volume of the dictionary more than bears out the promise of the preceding three, and will help to make the completed work an absolutely indispensable part of the equipment of every one engaged with the application of physical principles to the service of man, which indeed is already true of each of the four volumes now complete, so far as concerns the particular branches of physics to which they relate. The articles our readers are likely to wish to refer to most frequently are those relating to radiation in one form or another. They will find the theory of the subject ably set out by C. G. Darwin, M.A., F.R.S., the contents thereof treated by W. W. Coblentz, Ph.D., and an article filling some sixty-four columns by G. W. C. Kaye, O.B.E., D.Sc., M.A., on radiology, which covers all the most recent information concerning it.

Practical Wireless for All. By PERCY W. HARRIS. Pp. 71. Illustrated. London: The Wireless Press, Ltd. Price 1s. 6d. net.

This little book, of which the matter was first published in the form of articles in the monthly magazine *Conquest*, explains how to construct receiving sets at home. It is intended for the amateur who understands the general principles of wireless, and desires to make his own receiver.

The first chapter consists of general constructional hints, and the succeeding ones of directions for the construction of a crystal receiver, a single valve note magnifier, a two-valve receiver, a two-valve note magnifier, a three-valve receiver, and indoor aerials.

The sets described are simple, have been practically tested, proved to be efficient, and are incapable of radiation. The chapter on indoor aerials could be read with advantage by the majority of "listeners-in" who live within a few miles of a broadcasting station.

The information given is simple, sound, and concise.

Alternating Current Electrical Engineering. By W. T. MACCALL, M.Sc., M.I.E.E. Pp. viii + 493; figs. 368. London: The University Tutorial Press, Ltd. Price 15s. net.

This book, which forms a companion volume to the already well-known work by the same author on "Continuous Current Electrical Engineering," is intended for students who are taking a full time day course extending over several sessions or an advanced part time (evening) course in electrical engineering. The ground covered is such as to carry students up to the point when it becomes necessary to leave work of a more general nature and resort to books specialising in particular branches of the subject. The author may be commended for extending the scope of the work beyond that usual in books of this class and in this connection we find, in addition to the more usual sections dealing with machine work, a comprehensive account of measuring instruments for use on alternating current circuits, and chapters on transmission lines and their protection and on thermionic tubes. With regard to the latter there is no doubt that no modern

text book of electrical engineering can be considered complete unless the principles and fundamental applications of this device, which is likely in many ways ultimately to revolutionise electrical engineering, are discussed.

The book is carefully written and very few material points escape comment, indeed it would probably have been advantageous to omit mention of some details to which only a few lines have been given and to concentrate on the more fundamental principles. Thus, in the section dealing with protective relays for use in conjunction with switches, we find a large number of types described, some of which are but lightly touched on. In reading literature dealing with this subject we always feel what a great scope there is for a critical and comparative treatment bringing out the special spheres of usefulness and the limitations of the many devices put forward by the numerous workers on this subject.

Coming to matters of detail we find it stated that one of the disadvantages of the hot wire ammeter is that it cannot be used with several shunts on account of the variation of the resistance of the hot wire for different scale readings. Some error is caused by this matter, but the fact remains that such instruments are actually used with several shunts, the difficulty being got over, when necessary, by having two or more scales under the pointer.

With regard to the problem of maintaining the p.d. at the terminals of an alternator constant as the load varies, Heyland's compounded alternator is described at some length, but the very important practical application of an automatic regulator (of, say, the Tirrill type) is not discussed. An account of the Walker compounded alternator would also be of interest in this connection if only for the sake of the principle involved.

In connection with relays the author makes use of the term reverse current; while noting that he explains exactly what is to be understood by this term when used in connection with alternating currents, we think the term reverse power is more suitable and should be consistently employed.

The hope, expressed in the preface by the author, that errors and misprints have been kept to a low level, is fulfilled though a few are to be seen; thus one of the page references in the table of contents is erroneously given, a figure 2 is missing from under a root sign on page 25, and a letter is referred to in connection with fig. 14.06 which is not shown in the diagram. The author still retains the method adopted in his book on continuous current work of commencing the numbering of the figures afresh in each chapter; it is perhaps the result of greater familiarity, but on the whole the more usual system seems to be the simpler.

The author is to be congratulated on his book, which must have entailed very considerable labour in preparation and which can be recommended to teachers and students with perfect confidence.

Line Charts for Engineers. By W. N. ROSE, B.Sc. (Eng.). Pp. xii + 96; figs. 47. London: Chapman & Hall, Ltd. Price 6s. net.

One of the most notable tendencies of engineering design has been the use of graphical methods in lieu of the more cumbersome and lengthy mathematical processes of the past. The science of graphic statics—now a recognised part of the curriculum of every technical college—is a witness to this tendency. Similarly in the realms of pure and applied mathematics the use of the graph has gradually become of considerable importance as visualising the solution of equations and of problems. A direct development of the graph is the "nomograph," or the alignment chart, or more briefly still the line chart in which the variables connected by any simple mathematical law can be correlated by means of straight lines. As is generally known, the nomograph was first introduced by D'Ocagne in 1899, but it was only slowly that this particular method of solving problems was utilised, although in certain practical sciences, notably in naval architecture, it appears to have been employed more readily than in others. The alignment chart may be said to possess two great advantages over the ordinary graph: first, that it is far simpler to construct, particularly when complicated mathematical or trigonometrical functions are involved, and secondly, that when once constructed it can be used by persons who are not themselves capable of constructing the chart. Thus suppose, for example, we have obtained the chart for the resistance of platinoid wire, $R = .00005578l/d^2$ — not very difficult to obtain, by the way—then any person even if he possesses absolutely no mathematical knowledge can at once find the value of R for any given value of l and d by the simple process of drawing a straight line.

The author of this little book has treated the subject right from the very beginning, and thence through a series of well-graded examples he indicates how even complicated problems can be solved. The examples chosen are nearly all of them taken from engineering practice, although in this connection we could wish that he had taken a few more of his examples from electrical engineering practice. After indicating the method of preparing the "scales," one of the most difficult tasks in connection with the construction of line charts, he deals with functions such as Ohm's law, the chart for which is given, and then with functions of variables raised to any index—not necessarily a whole number—in which logarithmic plotting is required. The various charts are clearly drawn and the method of obtaining them is explained in a lucid and convincing manner, and altogether the author is to be congratulated upon a work which will enable any conscientious engineering student to master the preliminary difficulties of this very useful method of graphical computation. If we were to offer any suggestion for adding to the value of the book, it would be that at the conclusion of each chapter, a list of formulæ might be given for which alignment charts of the type dealt with in that chapter could be constructed. This would stimulate the student to apply the knowledge obtained to the solution of problems in his own particular sphere of engineering.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

N.E.C.T.A. Trading Policy.

I have read, with interested appreciation, the article published in your issue of June 8th on "The Organisation of the Electrical Industry," by "An Old Friend."

The writer, in referring to the foolish practice of wholesalers giving credit to persons whose financial standing is bad, has drawn attention to a state of affairs which should be rectified with the least possible delay.

The electrical contracting industry is suffering from many evils, and two of the greatest are:—

(1) The inefficient, untrained, and incompetent contractor who possesses just sufficient knowledge to be a menace and danger to the general public.

(2) The contractor without financial resources, who usually, before making his exit, *via* the Bankruptcy Court, runs amok and cuts prices to pieces.

The I.E.E. scheme for registration of electrical contractors, when in full operation, will, to a large extent, deal with the problem of those coming under the first heading. It is up to the wholesalers to put their house in order and to deal with those coming under the second heading.

Your correspondent's remarks on the genesis of the electrical contractor are probably correct, but surely he does not suggest that the door should be barred against an electrical operative becoming a master. In the case of many of our most successful contracting firms, the principals have risen from the ranks. It should, however, be an understood thing amongst the wholesalers that the starting in business of contractors with insufficient capital should be actively discouraged, and it should not be allowable that the insolvent contractor, having his supplies stopped by one wholesaler as a consequence of his inability to pay, should be able to go to another wholesaler and obtain credit facilities. It is, beyond question, extremely desirable that wholesalers should co-operate more than they do at present in the closing-down quickly of contracting firms that have become hopelessly insolvent and whose continuance in trade is harmful to the trade in general. The insolvent contractor must, of necessity, procure a certain amount of business in order that he may have money to dole out to pacify his creditors, and to obtain this business he usually quotes most absurdly low prices, often prices that do not cover the cost of the material used. By so doing he does the trade of the sound and legitimate contractor a very serious amount of mischief which is far-reaching in its effect.

One can understand that the problem confronting a wholesaler, who discovers that a contracting firm is unable to pay its accounts, is not an easy one to solve. He can either stop supplies and trust in Providence, or he can force the insolvent concern into liquidation. If he chooses the first course he probably, by waiting and using tactful pressure, recovers his money, and incidentally the burden is transferred to some other wholesaler who, being unaware of the insolvency, is prepared to accept orders and give credit. The second course of action rarely results in the recovery of much of the debt, but it does, undoubtedly, benefit the trade by the elimination of an undesirable trader.

The effect of these undesirable insolvent firms (I agree with your correspondent that they exist in large numbers) being allowed to continue in trade, is that a lowering of the status of the contracting trade takes place, and it comes into disrepute. Driven by the stress of the unfair competition of these undesirables, we find good-class contracting firms not only cutting their profits to the bone, but using cheap and inferior materials which in their innermost consciences they abhor. Profits being reduced almost to vanishing point, there is little or no money for publicity, with the result that the contracting trade, as a whole, is damned by other sections of the industry for its apathy and inefficiency. The cheap and often inferior materials that are being used are, in all possibility, of German origin, and their use means a distinct loss

of trade to the British manufacturer with its consequent effect on employment.

It is probable that the bad debts made by the wholesalers, taken in terms of a percentage on the profits earned, are greater in the electrical industry than in any other industry in the country, and the effect of these bad debts is that the wholesaler has to charge his solvent clients a higher price for the goods supplied than he would if he made no bad debts. Knowledge of this fact is tending to create a feeling of bitterness amongst the sounder elements in the contracting trade against the wholesaler.

Rome was not built in a day, and perhaps it is not quite reasonable to expect the Electrical Wholesalers' Federation, which has shown itself to be a very able, energetic, and enterprising body, to put its house in order to-morrow; but, by insisting that the sound business principles which govern the dealings of many of its members should be compulsory upon the whole, the E.W.F. would render an incalculable service to the electrical contracting trade.

Considerations of space do not permit of my traversing "An Old Friend's" criticisms of the various items of the published N.E.C.T.A. trading policy, but I can assure the writer that those criticisms, favourable and unfavourable, are welcomed.

The Contractors' Trading Policy being now outlined, it is desirable that other sections of the industry should give their views on it, criticise it, pull it to pieces, amend it, or, better still, adopt it. It is worthy of consideration as a sincere attempt to lay down the rules under which the game shall be played, in order that all concerned may concentrate on the game, instead of, as at present, scrapping amongst themselves over details in corners of the field.

P. Collinson,
Ex-President E.C.A.I.

Bradford, *July 14th*, 1923.

London Lead Oxide Co., Ltd.

We observe in the notice of new companies registered in your issue of the 6th instant that the above company is expressed to have among its objects the manufacture of electric batteries, accumulators, &c. We are instructed by the company to ask if you will be good enough, in the same connection, to note in your next issue that the company is not manufacturing, and does not propose to carry on the manufacture, of electric batteries or accumulators. The power to do so is among the general powers of the company, which it has no intention of putting to use, and steps will be taken to eliminate this clause from the memorandum.

Chas. G. Bradshaw & Waterson.

London, *July 19th*, 1923.

The Sale of Radio Apparatus.

We have received from a firm of *manufacturing stationers and printers* a notification to the effect that they have been entrusted with the sale, in the Eastern counties, of the wireless equipment of one of the leading electrical manufacturing companies.

We do not consider that this sort of thing is fair treatment to the electrical retailer, and would be glad to have your opinion, and those of other electrical retailers, on this subject.

A.M.I.E.E.

[Our views were set forth in our issues of January 19th and February 16th, 1923. We hold that the electrical contractor is entitled to preferential treatment provided that he, on his part, loyally supports the *British* manufacturer and does all that he can to promote the sale of apparatus.—EDS., ELEC. REV.]

A Shift Man's Complaint.

There is a central station "somewhere in England" of over 1,000 kW moving machinery (non-technical phrasing to hide locality) generating and/or distributing l.t., h.t., and e.h.t., which is left at night in charge (nine-hour shift) of a non-technical driver and a stoker (very much ditto).

Having been intimately connected with central-station work for twenty years I contend that these conditions are abnormal, and if they do not, ought to come under Board of Trade Regulations, *i.e.*, that there should always be one technical man on the spot and a junior.

The drivers mentioned above are engaged at a non-technical wage, but it is usually possible to get a man with some technical training driven to a lower grade by adversity, and to a highly-strung man this everlasting routine is like what we imagine penal servitude must be; his vitality is lowered, and eventually he gets dismissed for neglect of duty.

If anyone knows of worse conditions (and I have omitted to mention one or two minor facts which make the picture blacker still) obtaining in an electric light station, surely they ought to be remedied, as such jobs are only traps where a man can be bullied, his health ruined, and his character blighted.

One who has been Bitten.

C.T.S. Wiring in Workshops.

In reply to Mr. J. C. White's letter of the 16th inst. with reference to the above, I should like to point out that the wiring of chemical works is, to my mind, an entirely different matter from the wiring of workshops, owing to the peculiar conditions prevailing. I quite agree with Mr. J. C. White that the open system of wiring is suitable for very damp situations, such as laundries, where there is a considerable amount of steam present, but the great objection to its use is the entire absence of mechanical protection for the conductors. It should be borne in mind that cutting and damaging of conductors is not always deliberate—it is often accidental, and therefore every precaution should be taken to avoid the possibility of shock. A shock from 250 volts is unpleasant, especially on alternating current, while a shock from 650 volts is distinctly dangerous. If electricity is to make great strides in heating, cooking, lighting, and motive power the fear of shock must be removed from the mind of the layman; and a layer of rubber, although tough, can hardly be said to be adequate protection for conductors carrying juice at 650 volts. The reason for specifying the use of 2,500-megohm-grade cable for conduit wiring is owing to the increased tendency to break down to earth due to earthing of the conduit. I agree that judging the quality of cable by its appearance is a very difficult matter, but as the proof of the pudding is in the eating, so the quality of the cable is in the service it gives free from breakdown.

J. H. Sargent.

Chester, *July 23rd*, 1923.

With reference to Mr. W. E. Bradshaw's letter of the 16th inst., I am interested in what he calls "flogging a dead horse." My experience is that supply authorities at all times hold the trump card. I am told what sizes of wood screws to use, to say nothing of having had to make ridiculous alterations to satisfy the eccentricities of two or three inspectors. If I had not made these alterations I should not have obtained connection with their supply.

Could Mr. Bradshaw have forced the supply authority to give me a service? Could he force them to correspond with me and arrange for cables to be laid, &c.? I don't think he could. As a result I find it is most necessary to adhere to supply authorities' regulations to the very letter.

W. B. V.

July 21st, 1923.

Conditions in Persia.—Replying to a recent inquiry in these columns, Mr. T. Scott Anderson, M.I.E.E., writes from Bakewell as follows:—Persia is a country of various climates. In the South, bordering on the Persian Gulf, a tropical climate exists—excessively hot in summer, with an absence of any severe weather in winter. Date palms, orange, citron, and other heat-loving plants are found in abundance.

Travelling North to Shiraz, Ispahan, and Teheran, the Great Persian plateau is reached within 50 miles of Bushire, and the road leading to Shiraz is perhaps the most formidable of any hill-lands in the world. At Kazerun, midway between Bushire and Shiraz, the last vestige of the tropics is left behind, and in winter the whole country north of Kazerún is more akin to Siberian experience than Eastern; from the end of October until March the roads are snowbound, with fierce gales and at times impassable drifts.

From March to October the climate on the plateau is delightful, although for a few weeks very hot.

The caravanserais in Persia are what they were 2,000 years ago, and, of course, travellers must take with them every necessary required; this includes food as well as bedding, and all possible and essential sundries for ordinary comfort.

From Bushire to Shiraz the saddle is the only possible method of travel. From Shiraz to Teheran and on to Rasht (Caspian port) a form of Sedan chair is employed. North of Shiraz all kinds of Eastern fruit are obtainable.

Teheran to Meshed is, more or less, desert travelling, and the road is chiefly used by pilgrims to the shrine at Meshed. From Bagdad to Teheran is mountainous, and the road is wretched.

North of Teheran the country is more under cultivation.

The winters are severe, except south of Kazerún, and the summers hot and dry. Ten miles north of Kazerún, I have repeatedly seen twenty feet of snow in December, with the thermometer at 25 deg. below freezing-point, whilst at Kazerún snow has never been seen, and the thermometer will register 60 deg. in December.

Sanitation there is none—water should never be used for drinking purposes.

The hours after sunset are delicious.

The Metric System in Latvia.—The compulsory adoption of the metric system as from January 1st, 1924, has been definitely decided on. This embraces weights, measures, and distances, and will replace the antiquated system which will be totally abolished after the said date.—*Reuter's Trade Service.*

BUSINESS NOTES.

Bankruptcy Proceedings.—PERCY BOSWELL, trading as Boswell & Co., 110, Ebury Street, Westminster, S.W., electrical engineer.—The first meeting of creditors under the failure of this debtor, who filed his own petition, was held on July 17th at the London Bankruptcy Court, when accounts were presented showing liabilities £421 and assets valued at £26. The Official Receiver reported that it appeared from the debtor's statements in his preliminary examination that he had carried on business as an electrical factor. From 1906 until 1915 he worked on his father's farm. In October, 1915, he joined the Army, in which he served until April, 1920, when, having been severely wounded two years previously, he was discharged on medical grounds. In June, 1922, his father died, and the debtor then inherited £1,000 under the will of his grandfather. In the following month, having previously had considerable experience of electrical equipment, he began business as an electrical factor at 110, Ebury Street, S.W., with a capital of £100. An experienced electrician joined him, but provided no money for the business. The trade was mostly wholesale, and the debtor soon realised that his capital was insufficient, and he later on put another £50 into the business, working up a "good little business" and doing well until January. In that month the experienced electrician left, receiving for his interest in the business £65. The debtor says that afterwards he transacted less and less business. He attributes his insolvency to diminution of trade owing to the trade depression and to the contracting of book debts of doubtful realisable value.

Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, appointed July 19th.

CHARLES AND HERBERT THOS. WRIGHT, electrical engineers, 251, Fulham Road, Chelsea, S.W.—The receiving order in this case was made on a creditor's petition, and on July 18th the first meeting of creditors was held at the London Bankruptcy Court. Mr. D. Williams, Official Receiver, reported that it appeared from the statements of the debtors that they commenced business in partnership under a verbal agreement 25 years ago at Queen's Elm Parade, Fulham Road, removing in 1913 to their present premises. They did fairly well up to 1921, but had since made a loss which was ascertained for that year to amount to £700. No accounts had since been taken, but the liabilities had gradually increased. The partners had each drawn £6 weekly during 1919, 1920, 1921, and 1922, but the amount was then reduced to £4 each. They had been hopelessly insolvent during the past 18 months, but had kept on in the hope of an improvement in trade and being able to save this old-established business. They had paid out writs and executions to the extent, roughly, of £1,200. The petitioning creditor's debt was in respect of £300 borrowed in December, 1922, for the purpose of the business on the securing of the lease of the premises; they had also borrowed from other sources. A meeting of the principal creditors was held on May 31st, when, owing to the continued depression in trade, bankruptcy was resolved upon. The business was now practically at a standstill, and possession of the premises had been taken for £146, arrears of income tax. The debtors attributed their failure to the after-war slump in the electrical trade, to lack of working capital, and to the excess of drawings over net profits. A statement of affairs had been presented showing total liabilities £3,061, of which £2,429 was expected to rank against net assets, valued at £423, after allowing £191 for payment of the preferential claims. A resolution was passed for Mr. Wm. Strachan (Martin, Farlow & Co.), I.A., 50, Gresham Street, E.C., to act as trustee and administer the estate in bankruptcy.

EDWARD ENOCH MEARNS, 14, St. Bede's Road, East Boldon, Durham, electrical contractor.—The first meeting of the creditors was held on July 20th, at the Official Receiver's office, 4, Northumberland Street, Newcastle-on-Tyne. The statement of affairs showed liabilities of £290, and there was a deficiency of £212. Debtor attributed his failure to bad trade. It appeared that he started trading in February, 1918, as electrical contractor in partnership with another at 26, Cloth Market, Newcastle. In November, 1921, the partnership was dissolved, the liabilities being discharged, and debtor then traded at East Boldon, but trade was bad. The case being a summary one, was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Bainbridge & Co., Ltd.	10	Caine, T.	11
Baharie & Sons	21	Foxall, W. T.	24
Black, E.	17	Lipton, B., Ltd.	13
Electrical Devices, Ltd.	124	Bankers	17
E. G. S. Co., Ltd.	25		

STUART WIRELESS TELEPHONE CO. (trading as Arthur Curtiss Stuart and Cyril Charles Perrier), Kingsway Corner Buildings, W.C., and 22 & 24, Lamb's Passage, Bunhill Row, E.C.—These debtors should have attended before Mr. Registrar Mellor on Tuesday, at the London Bankruptcy Court for public examination, upon accounts showing total liabilities £4,134 (unsecured £3,165), and assets valued at £198. Mr. Armstrong, Official Receiver, reported that the debtor Stuart had not surrendered, and asked for his examination to be adjourned *sine die*. The debtor Perrier stated that the business was started by Stuart in June, 1922, and consisted of manufacturers of, and dealers in, wireless sets and parts, he (Perrier) being employed as sales manager until August, 1922. He then became a partner, and endeavoured to secure further capital for the business, but was not successful, and at a private meeting of the creditors, held last November, a resolution for bankruptcy was passed, and the business was closed. The debtor attributed the failure of the firm to depreciation in the value of stock, machinery, fittings, &c., to loss in trading, chiefly brought about by the delay in the commencement of "broadcasting," and to the loss incurred by the enforced destruction of a number of sets which did not conform with the Government regulations, issued in or about August, 1922. The loss on the trading was estimated at £942, apart from £1,250 loss incurred by enforced destruction of wireless sets. In further examination, the debtor stated that before becoming a partner in the Stuart wireless business he had traded as a caterer, a scrap metal dealer, a bookmaker, and a club manager and proprietor. The examination of Perrier was concluded, and that of Stuart was adjourned *sine die*.

HENRY FRANK MCDOWELL, Rosslyn, Knaresborough Road, Harrogate, merchant.—The receiving order in this matter was made on July 10th, on a creditor's petition. The statement of affairs show liabilities of £13,729, and there are no assets. Debtor attributes his failure to becoming guarantor for bank overdrafts of limited companies. It appears that for ten years prior to September last, he was managing director of an incandescent electric lamp company in Leeds. From September to June 1st this year, he was endeavouring to form a company, and since the latter date had been employed as a district representative of a London electric lamp company. He alleges that his position has been brought about entirely by the losses he sustained in connection with the promotion of companies, and that apart from such liabilities he does not owe any debts. He became aware of his position last September, when the bank began to proceed against him under the guarantees given by him on behalf of the above-mentioned companies.

JOSEPH MOSTON, Barlaston Old Road, Barlaston, Stafford, engineer.—The first meeting of creditors was called for Wednesday last, July 25th. The public examination takes place on August 13th. The statement of affairs shows a deficiency of £853, and the debtor alleges as the cause of failure his liability for the debts of the Stone Electrical Co. According to the observations of the Official Receiver, debtor states that prior to August, 1922, he was employed as a mechanic. In August, 1922, he paid £150 for a share in the business carried on by Mr. C. E. Boyce and two others under the style of the Stone Electrical Supply Co. at Stone, Staffs. Subsequently other persons joined the firm. The business was managed by Mr. Boyce up to December, 1922, when the debtor states he was dissatisfied with the management, whereupon one of the other members took charge of the office, and it was ascertained that the firm was insolvent. The debtor then obtained employment with a firm at Hanley, and in April last consulted the firm's solicitors, who summoned a meeting of creditors, at which they (the creditors) agreed to assent to a deed of assignment. The deed, however, was not registered owing to the failure of Mr. Boyce to execute it. Early in June last, the partnership stock and effects were sold by the Sheriff of Staffordshire under an execution issued at the suit of one of the creditors, and on June 21st another creditor, who had obtained judgment against the partners, served the debtor with notice of application for leave to issue execution against him, and he thereupon filed his petition.

FRANK SIDEBOTHAM RIPPINGILLE, Winchester House, Victoria Square, Birmingham, agent for electrical fittings.—The public examination of this debtor was held on July 18th at the Court House, Corporation Street, Birmingham. Debtor stated that prior to 1893 he assisted his father in a stove manufacturing business in Aston Road, but on his father's death the concern was sold. Under his father's will debtor received about £10,000, with which he commenced trading as a hardware manufacturer, being later appointed as managing director of a limited company which was formed. In 1905, severing his connection with the company, he started business as commission agent for iron and steel firms. On the control of the business by the Government during the war, he lost the position of commission agent for iron and steel companies, in respect of which his earnings were between £600 and £700 per annum. After the war he commenced trading as the Electrical Components and Conduits Tool Co., and he had a call on £1,000 for this business at 5 per cent. per month. Some of this money he had paid back, and borrowed again. Debtor had been engaged in much litigation. He had also patented a device for measuring the miles per gallon on motor-cars, and this patent was sold to a company which was formed, debtor receiving 1,000 shares and £250 as promoter. After further questions, the examination was adjourned.

THE LACLAND ELECTRICAL MANUFACTURING AGENCY, 68, Great Queen Street, W.C.—The first meeting of creditors was held last week at the London Bankruptcy Court under the failure of Richard James Wilfred O'Connor, who lately traded as

above and acted as agent for wireless sets. According to the debtor's statement, he roughly estimates his liabilities at £300, and has no free assets. He was demobilised in November, 1919, and was in employment until last October, when, without capital, he began the above-mentioned business. His father-in-law later on offered him £130, which money was put into the business. The claim of the petitioning creditor is, so the debtor asserts, in respect of printing catalogues which he did not use, because they advertised sets which were not marked "B.B.C." The demand was greater for sets so marked, with the result that the catalogue became a total loss. Owing to lack of capital, he became short of stock, and in February the business came to an end. Another wireless company then took over the fixtures, &c., and the tenancy agreement. On the formation of that firm, and under a deed, the debtor entered into partnership with another person, who provided £300 working capital, and he was to receive one-half of the profits of the business in respect of the goodwill. In consequence of the petition in bankruptcy presented against him (debtor), his partner requested him to retire from the business, and this he had done without any payment being made to him. He has since been without occupation. The debtor attributes his failure to lack of capital. The case remained in the hands of the Official Receiver.

THE ARC ELECTRICAL CO., Palatine Buildings, Victoria Street, Manchester.—Receiving order made on July 18th on creditor's petition.

JOHN HENRY WHITEHOUSE, 61, Martin Street, Morriston, Swansea, electrical engineer.—Receiving order made July 20th, on debtor's own petition.

NORMAN WILLIAMS, 19, Linby Close, Sherwood, Nottingham, MABEL WILLIAMS and WALTER COOK, both residing at 47, Bestwood Colliery, Nottingham, trading as the British Radiophone Co., makers of radio apparatus.—Receiving order made July 20th, on creditor's petition. (Substituted notice.)

H. J. A. MAULLIN, 206, Lozells Road, Hockley, Birmingham, painter, carrying on business as the Wilton Engineering Co., at 124, Devonshire Street, Birmingham.—Application for discharge to be heard at the Court House, Corporation Street, Birmingham, on September 13th.

Company Liquidations.—WIRELESS AGENCIES, LTD., manufacturers, exporters, and merchants of electrical and radio accessories, lately trading at 162, Shaftesbury Avenue, London, W.C.—In pursuance of the provisions of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on July 19th at the offices of Mr. W. H. Cork, accountant and auditor, 19, Eastcheap, E.C. A statement of affairs was presented, which showed ranking liabilities of £1,655, all of which were due to unsecured creditors. The assets were estimated to realise £504, from which had to be deducted £41 for preferential claims, leaving net assets of £463, or a deficiency, as regarded the creditors, of £1,192. The assets consisted of: Cash at bank, £58; stock, £429, expected to produce £198; fixtures, fittings, office furniture, &c., £48; book debts, £362, valued at £100; and other debts, £100. The deficiency, as regarded the shareholders, was £1,692. Mr. Cork said the case was a somewhat unsatisfactory one, and that there were matters that required investigation. The company was registered in January of the present year with a capital of £1,000, of which £500 had been issued, mostly for cash. A considerable amount of business was done in the early stages of the company's existence. On March 31st there was a bank overdraft of £350, which was subsequently increased to £500. The overdraft had been guaranteed by two directors, and had since been discharged. In addition, two of the shareholders, who were creditors for £600, had had their loans repaid during May and June, while three accounts guaranteed by directors or shareholders had also been paid during June. The company was interested in another concern called the Radolion Manufacturing Co., Ltd., which produced the goods which were sold by Wireless Agencies, Ltd. The majority of the goods produced, however, were unsatisfactory, and had to be sent back for repair. During the discussion which took place, the opinion was expressed by creditors that the matter called for a close investigation, and eventually it was decided to confirm the voluntary liquidation of the company, with Mr. Cork as liquidator, while a committee of the principal creditors was also appointed. The creditors are:—

	£		£
"Buff Book"	15	Haws, F.	13
Busby & Co.	16	Lithanode Electric Storage Co.	43
Burton, C. F. & H.	47	Mullard Radio Valve Co., Ltd. ...	146
Bacon, Elworthy & Co.	92	Pollock, W. J., & Co., Ltd. ...	27
Chloride Electrical Storage Co., Ltd.	33	Paragon Rubber Manufacturing Co., Ltd.	33
Crystophone Manufacturing Co., Ltd.	88	Radio Structa Manufacturing Co.	168
Cauldwell & Co.	32	Radio Instruments, Ltd. ...	80
Davis & Timmins	20	Stevenson, Hugh, & Son, Ltd. ...	19
Ever-Ready Co., Ltd.	21	Siemens Bros. & Co., Ltd. ...	135
Elwell, C. F., Ltd.	18	Wilkins, H. F.	39
Graham, Alfred, & Co.	225	Rowland, S. W.	33
Garland, S. T.	234	Schaap, Ellis	15
Goodyear Tyre & Rubber Co. ...	181	Sharp, David	32
Houghton Butcher Manufacturing Co., Ltd.	159	Sharp, H. P.	15

RADOLION MANUFACTURING CO., LTD., manufacturers of wireless sets, late 162, Shaftesbury Avenue, London, W.C.—The creditors interested herein were called together on July 19th at the offices of Mr. W. H. Cork, accountant and auditor, 19, Eastcheap, E.C. Mr. Cork submitted a statement of affairs which showed liabilities of £907, due to two creditors. The principal creditors were Wireless Agencies, Ltd., who were scheduled for £509, while the British Broadcasting Co. was put down for £397. The assets consisted of one share in the British Broadcasting Co., valued at £1, and fittings, &c., £4 18s., making a total of £5 18s., or a deficiency of £901. The company was only registered in February of the present year with a nominal capital of £500. The issued capital was £320, or a deficiency, as regarded the shareholders, of £1,221. The company's business consisted of the manufacture of wireless sets which were to be sold by Wireless Agencies, Ltd. It appeared that something like 1,000 sets had been made, but there were complaints with regard to the production, and it was estimated that there was a loss of something like £1 on each set. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued, with Mr. Cork as liquidator.

WHITESIDE BLOOMFIELD & CO., LTD., 10, Lower John Street, London, W., dealers in accessories and wireless goods manufacturers.—The creditors interested herein were called together on July 24th, at the offices of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., when a statement of affairs was presented which showed liabilities of £913. The assets totalled £910, but they were only estimated to realise £481, from which had to be deducted £21 for preferential claims, leaving net assets of £459, or a deficiency of £453. It was reported that the company was registered on October 13th, 1922, with a nominal capital of £500 in £1 shares. All the shares had been issued for cash, and were fully paid. The company had also occupied premises in Hanway Street, Great Windmill Street, a lease being obtained at a rental of £150 per annum, and manufacturing was carried on on the premises. Shortly after the formation it was found that the capital was insufficient and the directors had advanced nearly £250 to assist the company. Owing to the slump in trade it was finally decided to wind up. The turnover had totalled £2,704, with a net loss on the trading of £513. It was proposed to close down the business as it could not be carried on profitably or sold as a going concern. A resolution was passed confirming the voluntary liquidation of the company with Mr. E. H. Hawkins as liquidator.

The following are creditors:—

	£		£
Autoblatt Co.	16	India Rubber, Gutta Percha and	
Clifford & Co.	15	Telegraph Works Co.	14
Cables & Electrical Supplies ...	116	Jeffries & Co.	267
Castle T. L.	70	Lile John, Ltd.	17
Ebonite Part Supplies	17	Power Equipment Co., Ltd. ...	17
Fuller's United Electric Works, Ltd.	85	Standard Insulator Co.	17
Hightensite, Ltd.	11	Thames Valley Rubber Co., Ltd.	17
		Young, T. W., Ltd.	42

THE ELECTRICITY HOUSE, LTD.—A meeting of creditors will be held at 79, Lichfield Street, Wolverhampton, on July 30th. Liquidator, Mr. D. E. Campbell.

NAIROBI ELECTRIC POWER AND LIGHTING CO., LTD. (In voluntary liquidation.)—General meeting of members at 9 and 10, Pancras Lane, E.C.4, on September 17th to hear an account of the winding-up from the liquidator, Mr. G. A. Higlett.

"ALFO" ELECTRICAL ENGINEERING CO., LTD.—General meeting of members at 26, North John Street, Liverpool, on August 24th to hear an account of the winding-up from the liquidator, Mr. E. Chetter.

IRONCLAD SWITCHGEAR CO., LTD.—To be wound up voluntarily. Liquidator: Mr. W. P. Masterton, Bank of England Chambers, Tib Lane, Manchester.

ECONOMIC POWER, LTD.—Particulars of claims to be sent to the liquidator, Mr. M. Williams, Phœnix Works, Oakfield Road, Altrincham, by July 27th.

Private Arrangements.—SURREY SCIENTIFIC APPARATUS CO., LTD., Shrewsbury Works, Isleworth, electrical engineers and manufacturers of wireless apparatus.—The adjourned meeting of creditors of the above was held recently, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. It was reported that the meeting had been adjourned with a view to a cash offer of 5s. in the £ being submitted, but it had not been possible to obtain the support necessary to submit such a composition. It was further reported that proceedings had been commenced by creditors and executions had been levied. During the discussion which took place, the opinion was expressed that if a forced sale under the executions was proceeded with there would be little or nothing remaining for the unsecured creditors, and that it would be best for all concerned if a sale as a going concern could be effected. Eventually, it was decided to ask the company to pass the necessary resolution for voluntary liquidation, it being suggested that a liquidator might be able to come to terms with the execution creditors.

Dissolution of Partnership.—MONKS & KINDER, electrical engineers.—Messrs. W. Monks and J. F. N. Kinder have dissolved partnership, Mr. Kinder retiring from the firm.

Trade Announcements.—In the May *Bulletin* of the British Chamber of Commerce in Brazil (Inc.), it was announced that the METROPOLITAN-VICKERS ELECTRICAL EXPORT CO., LTD. (represented by Mr. H. W. Foy, as active member), was legally authorised to operate in Brazil. Its Rio de Janeiro offices are at Avenida Rio Branco, 46, 4° andar, Sala 10-11.

MESSRS. RICHSON & Co. have opened new showrooms at

offices at 113, Oxford Street, W.1, where they are displaying crystal glass and metal electric light fittings.

MR. H. M. TODD, who has had experience extending over many years on the erection staffs of the British Westinghouse, B.T.H., and other manufacturing concerns, has commenced business on his own account as an electrical power engineer for repairs and installation work at 12, Harvie Street, Glasgow.

As from July 23rd the address of MESSRS. HIRST, IBBETSON AND TAYLOR, LTD., will be 7a, Blackfriars Street, Manchester.

MR. A. W. MILLER, electrical engineer, of 39a, Queen Street, Aberystwyth, has taken over the stock of electrical fittings and accessories from the Chiswick Electricity Supply Corporation, Ltd., which has given up this branch of its business.

MR. WILLIAM NICKSON, JUNR., is continuing the business of his father, the late Mr. William Nickson, electrical engineer, of 54, Everton Road, Birkdale (Lancs.).

Mr. N. D. B. PHILLIPS, A.M.I.E.E., who is sailing for Canada in August, is willing to undertake commissions on behalf of firms interested in that market.

The works of the ELECTRIC HEATING Co., at Croydon, will be closed on the 31st inst., and re-opened on Tuesday, August 7th, partly for stock-taking purposes, but principally to complete plant alterations to increase the output by 50 per cent.

In view of statements that have obtained currency, the THOR ELECTRIC SAFETY LAMP CO., LTD., of Cardiff, asks us to state that the "Thor" lamp and all its accessories are, and always have been, of British material and workmanship; that all the directors, shareholders, patentees, and staff are British-born subjects; and that there is no foreign capital or interest whatever in the company.

Catalogues and Lists.—MESSRS. MAYALL & CO., LTD., 61, Moor Street, Birmingham.—A trade price list of electrical accessories and materials, fuseboards, conduits, switches, insulating material, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet F. 2,397, an illustrated and priced folder advertising "Doriclite" semi-indirect lighting fittings. Also Leaflet No. 3,069, announcing reductions in the prices of "Equiluxo" glassware.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Illustrated pamphlets dealing with a new design of "call" transmitter and receiver.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—A well-illustrated booklet dealing with electric winding gear.

MR. J. R. MORRIS, Imperial House, 15-19, Kingsway, W.C.2.—A pamphlet advertising "Columbia" dry cells for various purposes.

THE CABLE ACCESSORIES Co., LTD., Tividale, Tipton, Staffs.—An illustrated pamphlet advertising the "Revophone" crystal radio receiving set.

MESSRS. FALK, STADELMANN & CO., LTD., 83, 85, and 87, Farringdon Road, E.C.1.—An illustrated and priced catalogue of domestic electrical appliances—kettles, irons, grills, toasters, &c.

THE EVER-READY CO. (GT. BRITAIN), LTD., Hercules Place, Holloway, N.7.—A well-illustrated price list of electrical specialities, including hand lamps, torches, medical coils, dry cells, voltmeters, &c.

M. LOUIS HASSAUER, 30, Ely Place, Holborn Circus, E.C.1.—An illustrated booklet and pamphlets dealing with automatic switches—time and temperature—made by the Swiss Société Anonyme des Interrupteurs Automatiques.

ALUMINA METALS, LTD., 77, St. Mark's Road, Hanwell, W.7.—A pamphlet advertising "Alumina" metallic coating for protecting surfaces.

SCIENTIFIC SUPPLIES Co., LTD., 52, Hatton Garden, E.C.1.—An illustrated and priced catalogue of general laboratory apparatus and thermometers.

Mr. DAVID J. PATON, 43, Johnston Street, Westminster, S.W.1.—"Monthly Report," giving prices of insulating materials, copper, fuse wire, instrument wires, &c.

MESSRS. WM. GEIPEL & CO., Vulcan Works, St. Thomas Street, S.E.1.—Two pamphlets dealing with "Okonite" jointing tapes and splicing compound.

MESSRS. JAMES MCMILLAN & CO., Clun House, Surrey Street, W.C.2.—Catalogue No. 702, describing the "Glo" electric soldering iron, and an illustrated booklet dealing with the "Telur" telephone message timer.

"Freezor" Fans.—THE GENERAL ELECTRIC Co., LTD., had a busy time during the recent brief spell of hot weather. On July 13th, from 9 a.m. to 6 p.m., "Freezor" fans were sold at the rate of four a minute, or 100 separate orders an hour. The electric fan business in this country does not get such an opportunity very frequently.

Lead.—Messrs. James Forster & Co., in their statement dated July 21st, say: "The position of supplies of prompt lead owing to the strike, is getting serious, and consumers assert that, unless they can get lead out of steamers, they will have to close down. There is only a small quantity available on wharf and for this holders are getting from 10s. to 15s. per ton premium. And yet there is plenty of lead in the river in steamers unable to discharge their cargo! The general position of the metal, however, is unchanged. Consumers have been buying fairly steadily for both prompt and forward, but there is no scarcity of lead and the prospect is for ample supplies during the next two months."

Book Notices.—"Electricity Supply Accounts," by George Johnson, F.R.S.A., F.L.A.A., &c. (Pp. 181). London: Gee & Co. (Publishers), Ltd. Price 10s. 6d. net.—This is the third edition of a book originally entitled "Electric Lighting Accounts," but which now takes into consideration the large business in other directions done by electricity undertakings. The effect of the last two Electricity (Supply) Acts has also received attention. These Acts contained many subsidiary and consequential provisions which have a direct bearing upon the accountancy of electricity supply undertakings, as, for instance, the superannuation of employés, compensation for loss of position due to the operation of the Acts, the provision of funds for the needs of the Commissioners, and numerous other matters. For these and other reasons a new edition was rendered necessary, and no doubt electricity supply authorities will be glad of its assistance.

Scientific Papers of the U.S. Bureau of Standards, No. 468, "Formulas and Tables for the Calculation of the Inductance of Coils of Polygonal Form" (price 10 cents); and No. 471, "Methods of Measurement of Properties of Electrical Insulating Materials" (price 15 cents). Washington: Government Printing Office.—The first of these papers is produced with a view to the calculation of the inductance of frame aerials. The other deals with the measurement of phase difference and dielectric constant and voltage effect at radio frequencies; volume and surface resistivity; density; moisture absorption; mechanical characteristics; thermal expansivity, and other properties of insulating materials.

"Alternating Currents: Their Theory and Transmission," by Edgar T. Larner, A.M.I.E.E. Pp. iv+198; 107 figs. London: Crosby Lockwood & Son. Price 6s. net.

"The King's Engineer" is the annual journal of the Engineering Society and the Engineering Branch of the O.S.A. of King's College, London. The second issue, recently received, contains in full the anniversary address delivered by Mr. C. H. Wordingham, C.B.E., in February last, and "some recollections" by Mr. J. S. Highfield, together with many other interesting items.

Annual Sports.—The annual sports of the Bushbury Engineering Works of the Electric Construction Co., Ltd., were held on July 14th; some 800 employés and friends were present. As well as races and other athletic events, tennis and bowls matches took place, the finals of a number of the annual competitions having been reserved for sports day. The E.C.C. sports grounds, which now comprise 11 tennis courts (nine grass and two hard) and bowling and putting greens, were in excellent condition, and the E.C.C. band

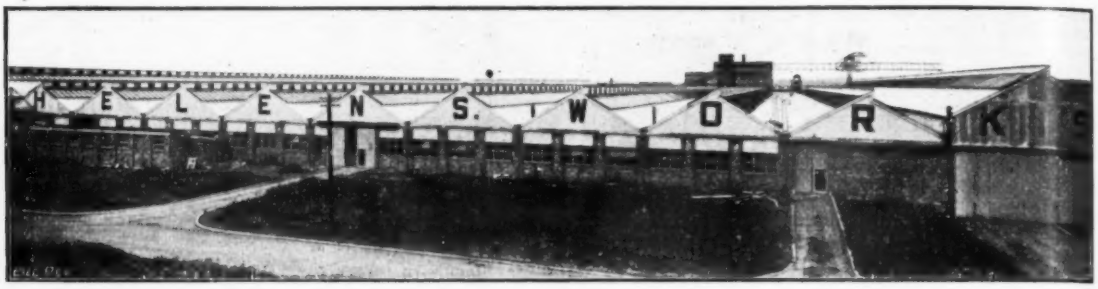
A STERLING LOUD-SPEAKER EQUIPMENT.

played during the afternoon, the proceedings concluding with an impromptu dance in the mess-room.

The annual sports meeting of the Sterling Athletic and Social Club was held at the club ground, Dagenham, on July 14th, when a record number of nearly 500 competitors entered. A very full programme was carried out under excellently-organised conditions. Mr. Guy Burney, president of the club, and managing director of the Sterling Telephone Co., was present, and Mrs. Burney distributed a large assortment of valuable prizes and cups. Events and results were announced by a series of "Tele-megaphone Magnavox" loud speakers, which proved of great interest and convenience to the 3,000 spectators present. The "Magnavox" equipment

employed is depicted in the accompanying illustration. The whole of the amplifying apparatus was accommodated in a small room at the base of the tower, and in the evening the system was used in connection with a "Sterling" 2-valve receiving set to pick up the broadcasting from the London station.

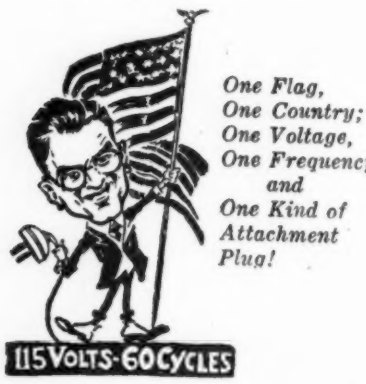
St. Helens Cable Staff Transfers to Slough.—During this week the transfer of the staff of the St. Helens Cable and Rubber Co., Ltd., from Warrington to the new works at Slough, has been taking place. From to-morrow's date, July 28th, all communications should be addressed to the company at Slough. New telephone No.: "333 Slough" (3 lines); telegraphic address: "St. Helens, Slough." The whole of the plant has not yet been removed, but a sufficient quantity of new plant has been put down at Slough, in addition to a certain amount removed from Warrington, to enable the company to start manufacture early in August. As matters progress, so the plant at Warrington will gradually be shut down and removed to Slough. Every precaution is being taken to prevent difficulties arising with regard to delays in delivery of orders, and customers need not anticipate any trouble owing to the change-over.



THE ST. HELENS CABLE WORKS AT SLOUGH.

Electrical Plant for Irish Quarries.— The slate quarries at Killaloe, County Clare, which have been closed and idle for some years past, have now been purchased by a Cork company, and work has been recommenced. The machinery for the proper and up-to-date working of the quarries will include a suction gas and electrical plant and several slate saws, and all these necessary apparatus and appliances are to be immediately installed at a cost of about £12,000, so that within the next month or two some 300 hands will be engaged in the quarries, and later on fully 600 will be employed at the work.

National and Electrical Unity.—The accompanying illustration and statement are reproduced from a recent issue of



Electrical Merchandising, and, *mutatis mutandis*, may well be taken to heart by British electrical men.

The Highland Show.—Edmundson's Electricity Corporation, Ltd., Inverness, had an attractive stand at the Highland and Agricultural show last week. The exhibits embraced sets for lighting and power installations for country houses, farms, factories, &c. The leading feature was a special type of water turbine, which has already gained favour in many parts of the country, and in connection with this the Corporation had utility lighting sets, which could be established with a minimum of expense and trouble.

The Boilermakers' Lock-out.—On July 18th, Sir Montague Barlow, Minister of Labour, interviewed representatives of the Shipbuilding Employers' Federation in connection with the lock-out of the boilermakers from shipyards. No official statement was issued after the meeting. On the previous day the Minister met the general secretary and other members of the Boilermakers' Society.

The Times of July 25th stated that the Minister had informed the union that the Act required that the consent of both sides must be obtained before a dispute could be sent to arbitration, and as the employers objected to preferential treatment being given to the boilermakers over other unions which were working the agreement, and would not therefore agree to arbitration, he was unable to accede to that request. With regard to a Court of Inquiry, the Minister's view was that for obvious reasons this was not a suitable dispute for such an inquiry, the only purpose of which was to ascertain the facts and present a report.

Applications for British Trade Marks.—The following are among the recent applications for British trade marks. Objections to any of them may be made within one month of the dates mentioned:—

M. O. Cecil (lettering and design). No. 435,381. Class 8. Accumulator batteries, cables, circuit breakers, induction coils, telegraphic, telephonic and wireless telephonic apparatus, &c. Mansell & Ogan, Ltd., 15-17, Cecil Court, Charing Cross Road, London, W.C. July 18th, 1923.

Ethita. No. 436,131. Class 8. Crystals and apparatus for use in wireless telegraphy and telephony. Arthur W. Bailey, trading as the Bright Co., 47, Topsfield Parade, Crouch End, London, N. July 18th, 1923.

Igranic. No. 437,252. All goods in Class 8, but not including rheostats. Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C. July 18th, 1923.

Edinaphone. No. 437,376. Class 8. Wireless telephonic receiving apparatus. Scottish Radio Centre, Ltd., 133a, George Street, Edinburgh. July 18th, 1923.

Sentrilock. No. 436,845. Class 13. Electric switches. Ernest Smith, The Grange, Strines Road, Strines, Cheshire. July 18th, 1923.

Bencolite. No. 438,004. All goods in class 15. The Benjamin Electric Co., Ltd., Brantwood Works, Tariff Road, Tottenham, N. July 18th, 1923.

Annual Outing.—On July 14th, the employés of the Hart Accumulator Co., Ltd., of Stratford, went to Hastings for their 25th annual outing. Following an excellent luncheon at Ferrari's Restaurant, brief remarks on the continued prosperity and expanding business of the company were given by the chairman, Mr. F. J. Holmes, director and general manager of the company, to which Mr. R. Wheatley, works superintendent, suitably responded. The party spent the rest of the day according to their own inclinations.

Fire at Deptford.—The Dussek Bitumen Co. informs us that the fire which took place at Messrs. Dussek Brothers' works at Deptford in no way affects the business of the former company, whose works are at Bromley-by-Bow.

Messrs. Dussek Bros. & Co., Ltd., state that although the resin oil distilling plant at their Trundley Road works was entirely destroyed, the business is not interfered with in any way.

British Empire Exhibition Notes.—The Hackney Electricity Committee has considered the proposals of the British Electrical Development Association with regard to the electrical exhibit at Wembley and recommends that the scheme be supported and that the sum of £350 be provided towards the cost.

A similar decision has been come to by the Bradford Electricity Committee, whose contribution (based on £1 for each £1,000 of revenue) will amount to £443. In this case, however, the Committee adds the proviso "subject to a satisfactory response to the appeal being made on the part of other electricity undertakings in West Yorkshire."

Local Exhibition.—LIVERPOOL.—The Tramways and Electricity Committee is hurrying forward its arrangements for an exhibition of electrical appliances to be given at central premises in Parker Street, Liverpool, in the near future.

A Brookhirst Display.—Through the courtesy of Berry's Electric, Ltd., Brookhirst Switchgear, Ltd., has been able to arrange an exhibition of its motor-control gear at 5, Deansgate, Manchester. This remains open to visitors until the end of October.

Canadian Exhibition Train in France.—The Canadian Government, with the help of the French Chamber of Commerce, has organised an exhibition train, consisting of 30 motors (5-ton Renaults) and 30 tractors, showing various Canadian productions and specialities. The train is five kilometres long when on the road, and includes two cars fitted with kinematograph apparatus.—*Reuter's Trade Service* (Rouen).

International Exhibition at Dunedin (N.Z.).—It has been decided by the Provisional Committee of the Dunedin Exhibition to make the display international instead of Imperial. It will be called the New Zealand and South Seas International Exhibition. A company is to be formed with a capital of £100,000. It is planned to hold the display in 1925-1926.—*Reuter's Trade Service* (Melbourne).

The Shipping, Engineering, and Machinery Exhibition.—Official Bulletin No. 4 gives a preliminary list of 260 exhibitors, of which about 50 are electrical firms or companies producing plant employed in the electrical industry. A number of the leading institutions are making official inspections of the exhibition, which is to be held at Olympia in September.

Foreign Exhibition.—FRANCE.—Upon the occasion of the fiftieth anniversary of its foundation, the Société Française de Physique is organising a physical and radio exhibition, to be held at the Grand Palais, Champs-Elysées, from November 30th to December 17th. The principal scientific and technical societies of France are lending their support to the scheme, including the Comité Electro-technique Francaise, the Société Francaise des Electriciens and the Union des Syndicats de l'Electricité. The exhibition will be divided into 19 groups, and among them will be sections covering the following:—Radio apparatus; X-ray apparatus; telegraphy and telephony (wired); distribution of electricity and domestic applications; electro-chemistry, dry cells, and accumulators; cables; insulating materials and glassware; kinematograph apparatus; electric lighting; and electric heating.

Electricity Supply Rifle League.—The following are the results of recent matches:—City Co., 585, Metropolitan, 572; Central A, 583, Hackney, 534; County, 581, Hackney, 544; City Co., 587, St. James', 557; City Co., 584, Hackney, 533; St. James', 571, Central A, 569; St. James', 569, Central B, 556; County, 581, Metropolitan, 578; County, 585, Shoreditch, 579; City Co., 583, West Ham, 506; Shoreditch, 587, City Co., 580; Shoreditch, 590, West Ham, 482; Central A, 566, Metropolitan, 575; Metropolitan, 578, Central B, 547. The County Co. heads the list with 16 points (possible).

Capital Reduction.—ALLOY WELDING PROCESSES, LTD., and REDUCED.—A petition for the confirmation of the reduction of the capital of the company from £130,000 to £45,000 was presented to the High Court on July 10th and will be heard on July 31st.

Russian Insulator Production.—In the production of high-voltage insulators Russian factories are claiming considerable success. In pre-war times these were obtained almost entirely from abroad, and the conductor line Kaschir-Moscow, put up last year, was also equipped with foreign-made insulators. However, 22,000-V insulators have now been successfully produced in Russia and these will be largely used on the Caucasian oilfields. Work is now being organised for the production of 33,000-V insulators.

For Sale.—On July 31st, Messrs. Henry Butcher & Co. will sell by auction at 11, Balham Grove, S.W., a quantity of plant and machinery, including gas engines, a.c. and d.c. motors, &c.

The Borough of Hampstead Electricity Department has for sale two Thompson water-tube boilers and accessories. (See our advertisement pages to-day.)

Holidays.—The works of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, were closed on Friday last, July 20th, and will remain so until the morning of Monday next, July 30th, for the annual holidays.

The works of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., will be closed from this evening until Tuesday, August 7th, for the annual holidays.

The works of the LONDON ELECTRIC FIRM, Croydon, will be closed from Saturday, August 4th until August 13th.

Fires.—An outbreak of fire occurred on July 20th in the basement of the offices of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Paradise Street, Birmingham. A number of packing cases in the basement were burned, and, in addition, damage was caused to electrical equipment. The outbreak was quickly subdued. The cause of the fire has not yet been ascertained. The company announced that provision was at once made for the continuance of business without any interruption.

THE EBONESTOS INSULATORS, LTD., of London, S.E., state that the serious fire which occurred at their works on July 19th, did not affect their valuable moulds and moulding presses. They hope to have a temporary finishing department in running order by the end of this month, so that production will not be seriously restricted after that date.

The premises of the LIGHTING SUPPLIES CO., 2, Finsbury Avenue, Eldon Street, London, E.C.2., were burnt out on Saturday last, but the stock is being replenished and correspondence should be addressed as usual.

Spain's Foreign Trade.—Statistics of Spain's foreign trade during 1922 show an excess of imports amounting in value to 1,584,000,000 pesetas, the figures for imports and exports being as follows:—Imports, 3,033 million pesetas; exports, 1,449 million pesetas. This adverse balance, which is much larger than that for the years 1921 and 1920, has caused a good deal of concern. Some see in it an inexplicable increase in Spanish purchases abroad, but the fact is generally overlooked that up to 1921 the same basis of calculation of values had been maintained as in 1913, while for 1922 new values were determined more in conformity with the present prices of goods. Nevertheless, exports increased, especially those of manufactured goods. Among the imports of manufactured goods were dynamos, electric motors, &c., valued at 20,000,000 pesetas.—*Reuter's Trade Service* (Madrid).

Deed of Assignment.—D. J. CHAMBERS, 45, Thicknesse Avenue and Volta Works, Dawber Street, Wigan, electrical engineer (trading as "Chambers & Co.," and "The Electrical Supplies Co."—Claims and assents to deed of assignment to be sent to the trustee, Mr. A. H. Scampton, 28, Market Street, Wigan, by August 15th.

LIGHTING AND POWER NOTES.

Baildon (Yorkshire).—ELECTRICITY SUPPLY.—The District Council has decided to take immediate steps with a view to securing a supply of electricity for the area, and has invited the Yorkshire Electric Power Co. to submit a scheme.

Blackburn.—YEAR'S WORKING.—The annual report of the engineer and manager of the Electricity Department (Mr. P. P. Wheelwright) notes an increase in revenue from £116,446 to £145,893. At the same time the expenditure fell from £87,480 to £77,684, leaving a gross profit of £68,209, as compared with £28,966 in the previous year. Although the capital charges were higher by about £19,000, a net profit of £12,743 resulted, comparing with a loss of £6,161 in 1921-22. The capital account records an expenditure of £191,269 during the year on account of the 1920 extensions, including £109,020 for the new generating station and £44,858 for mains and distributing plant. There was a large increase in the amount of energy sold—from 10,244,361 to 16,308,717 kWh. The second generating set and boilers at the Blackburn (East) generating station were put into operation during the year, and the running is said to have been satisfactory. The report states that the final cost of the new station will be within the estimate of £700,000. The cost per kW installed works out at £35, taking 20,000 kW as the basis.

Bradford.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £37,000 for electricity purposes.

NEW PLANT.—According to a report prepared by the city electrical engineer (Mr. Thos. Roles), the total converting plant is of 17,300-kW capacity, of which 4,300 kW is allocated for tramway power, leaving 13,000 kW available for general supply. Last year the maximum general demand from direct-current users was 12,300 kW, and a big series of extensions in the city promises a maximum in the coming winter of some 13,750 kW, or 750 kW beyond the normal plant capacity. To meet the increase in the next two years, it is proposed that the sub-station at Sunbridge Road should be equipped as a converter sub-station for general d.c. supply. The building at present is not fully utilised. It has one 250-kW rotary converter, used for tramway purposes, and it is proposed to remove this plant to a more suitable site on the outskirts of the city, and to install at Sunbridge Road four 1,000-kW rotary converters and switchgear. It is suggested that the complete scheme should not be carried out immediately, but should be divided into two sections of two machines at a time, according to the demand of the increased load. This scheme, together with the installation and rearrangement of feeders, will involve an expenditure of £34,240. The Finance Advisory Committee has approved this expenditure. The Electricity Committee and the Finance Advisory Committee have authorised further inquiries to be made, with authority to place an order for a large turbo-generator set for the Valley Road generating station. Tenders received for this equipment show, it is stated, a large difference in price between English and foreign firms. The Committee desires to place the work in English hands if possible, but the prices are heavily in favour of foreign firms.

Canada.—HYDRO-ELECTRIC SCHEME.—Bonds are being issued by the Southern Canada Power Co. in connection with the development of Hemming Falls. In a descriptive circular it is stated that a complete hydro-electric plant capable of generating 30,000 h.p. will be constructed. There is an immediate demand for over 20,000 h.p. The properties of the company on completion of development work about to be carried out will consist of hydro-electric plant having a capacity of 44,000 h.p. and undeveloped powers capable of a further extension of 110,000 h.p.—*Electrical News* (Toronto).

ONTARIO.—An order for two 58,000-h.p. turbines has been placed by the Hydro-Electric Power Commission with the Dominion Engineering Works, Ltd., Canadian licensees of the American Cramp organisation. The Dominion company has

also been awarded a contract for two Johnson penstock valves and two sets of I. P. Morris governors, all to be built from Cramp I. P. Morris designs. There are now three sets under construction by the Dominion Company for the Queenston installation of the Commission. Three other sets, now in operation for the Commission, which were built in the Cramp I. P. Morris shops in Philadelphia, were imported into Canada. One of these was recently selected by the Commission's engineers for an efficiency test. Results showed an efficiency, under rated full load, of 93.4 per cent., and the average efficiency throughout the full range of load is believed to be the highest ever attained in any prime mover.

Chester.—Year's Working.—The accounts for the year ended March 25th, 1923, of the city electricity undertaking (engineer: Mr. S. E. Britton) show a total income of £52,988, comparing with £50,278 in the previous year. The working expenses amounted to £28,898, as against £39,036, leaving a greatly increased gross profit—£24,090, as compared with £11,242. As the capital charges remained at about the same level, the net profit was increased by the same extent, being £12,434, as against £803. The charges against this included £16,524, transferred to capital account, and a debtor balance of £7,902 was carried forward. The capital expenditure, which included items of £36,600 for plant and machinery, and £16,315 for buildings, amounted to £73,175. The supply statistics show a slight increase in the amount of energy sold—from 3,539,560 to 3,722,242 kWh. The maximum demand rose from 2,064 to 2,305 kW. Mr. Britton, in his report, says that now the undertaking has surplus plant, owing to the purchase of the Queensferry station, the development of domestic supplies will be facilitated. Progress will depend upon the policy adopted by the Electricity Committee regarding the supply of energy and apparatus to consumers.

China.—Tientsin.—The Compagnie de Tramways et Eclairage de Tientsin, a Belgian undertaking, reports that during the past year the number of passengers carried on the tramways was 57,785,000, as compared with only 44,769,600 in 1921, an increase of 29¼ per cent. The number of lamps supplied from the company's station increased from an equivalent of 2,978,000 to 3,450,000 c.p., an advance of 16 per cent. Disappointment is expressed with regard to the demand for current for power purposes, which has not shown the progress anticipated. The two spinning mills in which electrical plant was installed by way of experiment decided not to go on with the scheme. As a result, it has been decided to postpone the projected order for an additional 3,000-kW turbo-generating set for the power station, the capacity of which remains at 9,000 kW. The company has recently added 35 trailer tramcars to its rolling stock, which now comprises 65 motor-equipped vehicles and 85 trailers.

Continental.—Italy.—Important hydro-electric works are to be carried out by the Società per le Forze Idrauliche della Sila and other companies, aided by the State, in the Sila Mountains, Calabria. By the construction of immense reservoirs, it is estimated that 160,000 h.p. can be developed. The cost of the project is put at 400,000,000 lire. A subsidy of 40 lire per h.p. for a period of 15 years will be paid by the Government amounting in all to about 100,000,000 lire. According to *Commerce Reports*, doubt is expressed as to the ability of the companies to dispose of the power, and it is possible that long-distance transmission to Messina (Sicily) and Campania will be resorted to.

Latvia.—*Commerce Reports* states that the Cabinet has allocated large sums for the building of hydro-electric stations on the Dvina River. It is said that the total available power at four sites is 375,000 h.p.

Russia.—A project is being worked out for the creation of a storage reservoir at Lake Ilmen to compensate for the periods of decline in the volume of the Volchoff water supply, which may cause the station's capacity to fall from the normal of 51,000 kW to as low as 28,000 kW.

The Government electrical station, Elektroperedatch, has completed its tenth year. It was the first Russian regional station, built next the rich peat deposits 75 versts (about 50 miles) from Moscow. This station rendered particularly useful service during the severe fuel crisis of 1919-1920, when it was forced to its utmost capacity and furnished Moscow with over half the electricity it used. It was only in 1921, when petroleum reappeared in Moscow to rectify the fuel situation, that a thorough repair of the plant could be undertaken. It is proposed to extend the establishment.

France.—The French Senate and the Chamber of Deputies have passed the Bill relating to the distribution of electrical energy in country districts. Under this law a credit of 600,000,000 fr. will be placed at the disposal of the Office National de Crédit Agricole for the grant of loans to the departments, communes, and co-operative societies for electrical installations. These schemes will be carried out under the control of the local (State) engineers.

Falkirk.—New Plant.—The Electricity Commissioners have sanctioned the extension of the Corporation generating station by the installation of one 3,000-kW, 3-phase, 50-cycle turbo-alternator, together with the necessary boiler plant.

Faversham.—Electricity Charges.—The Town Council has received an Order from the Ministry of Transport authorising the maximum price of electricity to be fixed at 10d. per kWh.

Featherstone.—Electricity Supply.—The Urban Council has sealed an agreement with the Electrical Distribution of Yorkshire, Ltd., for the supply of electricity for public lighting.

Hoylake.—Loans.—The Hoylake and West Kirby Council is to apply to the Electricity Commissioners for sanction to the borrowing of £1,164 for the purpose of an economiser, &c., and £2,000 for mains and services.

India.—Madras Hydro-Electric Scheme.—It is stated that two members of the firm of Messrs. Alfred Dickinson and Co., consulting engineers, of London and Birmingham, have applied to the Government of Madras for a licence for the sole right to collect and store the water of the catchment area of the Pykara River in the Nilgiris, and to utilise it for the development of electrical energy for general industrial purposes. The application has been made on behalf of a syndicate composed of the two applicants in conjunction with Messrs. Balfour, Beatty & Co., Ltd., and the General Electric Co., Ltd., of London. The company has made the necessary survey, and the scheme contemplates the transmission of power to the port of Calicut.—*Indian Engineering.*

Irish Free State.—Electrical Developments.—At the meeting of Dail Eireann last week, Professor Whelehan, Assistant Minister for Industry and Commerce, in reviewing the work done by his department, said (amongst other things) that a number of applications had been received at the Ministry of Industry and Commerce for the generation of electricity, particularly in country towns, and these had been in most cases approved after full consideration. Proposals for hydro-electric development on the River Liffey had been considered, and information and assistance given to the parties concerned in their promotion.

Kingstown.—The Ministry of Industry and Commerce is to hold an inquiry at the Town Hall on July 30th into the application of the Urban Council for sanction to the borrowing of £33,000 for the erection of a generating station in the district.

Japan.—Proposed Electrical Trust.—It is reported that negotiations are on foot with the purpose of bringing under one control all the power stations in the country. The scheme, which is believed to have been promoted by the Fukuzawa interests, connected with many enterprises in Central Japan, is claimed to have had an encouraging reception in many quarters, and all the leading electrical concerns are expected to associate themselves with it sooner or later.—*Reuter's Trade Service* (Tokio).

Leeds.—Extension of Supply.—The Electricity Committee has decided to apply to the Ministry of Health for power to supply electricity to houses on the Cookridge Gardens estate.

Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £40,000 for mains and services.

Leigh.—Loan.—The Electricity Committee has recommended the Town Council to apply to the Electricity Commissioners for sanction to borrow £37,572 for mains, services, &c.

London.—Hackney.—*Unemployment Relief Schemes.*—The Electricity Committee has formulated two schemes for the relief of unemployment in the borough during the coming winter, and recommends that they be submitted to the Unemployment Grants Committee as alternative schemes for financial assistance. Scheme (*a*) is for the conversion of all street lamps in the Stamford Hill district from gas to electricity, and for every other lamp in the borough which could be conveniently linked up to an existing main. The number of lamps involved is 1,450, and the estimated cost £24,250. Scheme (*b*) provides for the conversion of the whole of the lamps in the borough from gas to electricity. In connection with this scheme, assuming that only a single run of cable is laid down, about 50 miles will be required. The capital cost, excluding feeder cables, feeding centres, and other distributing work, will be approximately £100,000, and, in addition, a sum of £35,000 should be provided for lamp service work.

Mains Extensions.—The Committee has approved a total of 2,600 yd. of mains extensions at an estimated cost of £3,014.

Fulham.—The Electricity and Lighting Committee recommends the following discounts on account of large supplies, subject to the consumers' entering into fresh agreements for a period of five years:—Where the total account is not less than £1,000 in any quarter, a discount of 5 per cent. on the charge of ¼d. per kWh, plus extra coal charge for all kWh registered. Where the total account is not less than £2,000 per quarter, a discount of 10 per cent. under the same conditions.

Mansfield.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £3,000 for meters.

Newport (Mon.).—Mains Extensions.—The Electricity Committee proposes to extend the mains in certain portions of the town at an estimated cost of £3,000.

(*Continued on page* 143.)

B.T.H. COMPOUND-FILLED SWITCHGEAR.

Two interesting installations of ironclad compound-filled switchgear have been completed recently at the Church Lane (Tottenham) and New Southgate sub-stations of the North Metropolitan Electric Power Supply Co. The Church Lane equipment controls the 11,000-volt, 3-phase feeders from Edmonton and Wood Green sub-stations, and as may be seen from fig. 1, consists of two three-panel switchboards mounted one on each side of the sub-station. Four of the panels control 0.1 sq. in. feeders, and the remaining two panels are input equipments fitted with remote-control mechanism to enable the oil circuit-breakers to be operated from the gallery.

In construction the switchgear may be regarded as an evolution on the lines of the well-known truck-type switchgear, originated many years ago by the British Thomson-Houston Co., Ltd., of Rugby, and the installation described is of additional interest because it is claimed to be the first compound-filled truck switchboard to be installed.

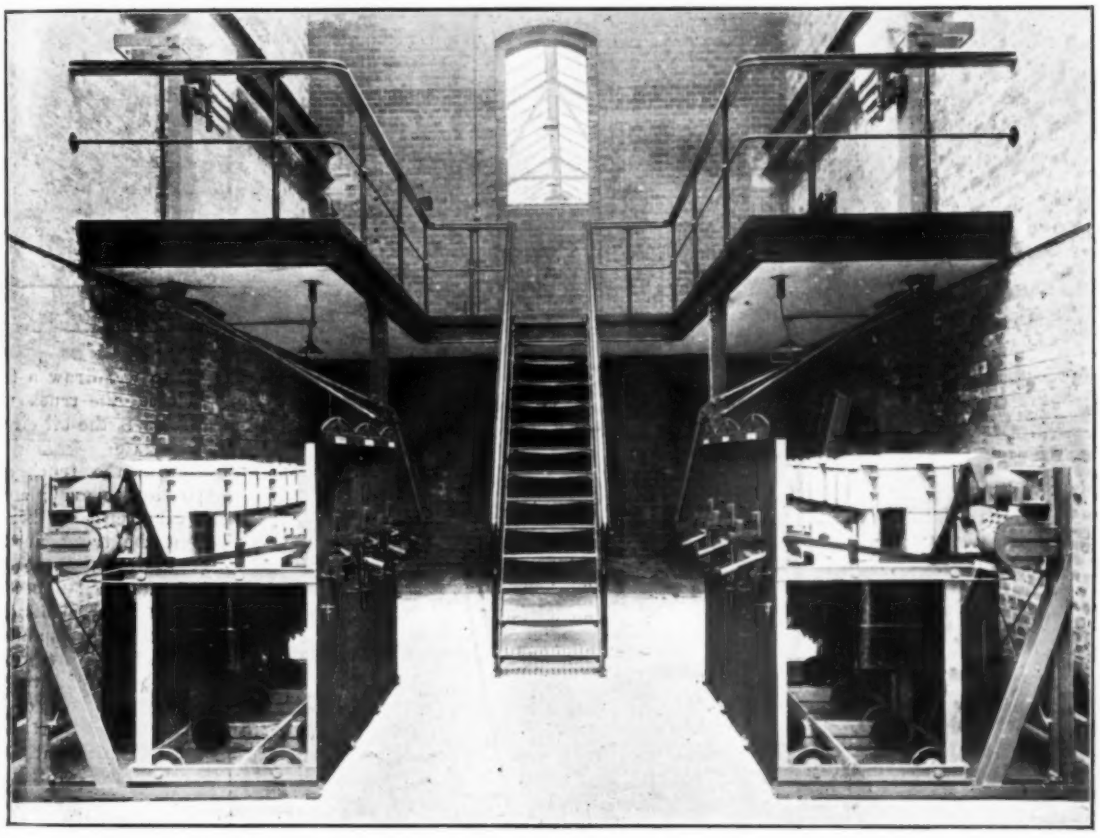


Fig. 1.—B.T.H. Compound-filled Switchgear at Church Lane Sub-station.

Like their prototype, the equipments are constructed on the unit principle, and consist essentially of a fixed busbar element and a movable truck, the former comprising a mild steel framework carrying the busbars and cable box, and the latter including the circuit breaker, current transformers, and instruments. These features are clearly shown in the accompanying illustrations; the details of construction can best be described by tracing the course of the conductors from the busbars to the circuit cable box.

The busbars consist of laminated copper strip, mounted in and projecting through robust porcelain insulators firmly cemented at the ends of a circular cast-iron chamber.

Annular contacts, for engagement with the plugs on the movable truck, are mounted on contact castings firmly bolted to the busbars and supported in porcelain spout insulators, which are cemented into suitable openings in the busbar chamber. Provision is made for renewing these contacts from outside after the chamber itself has been filled with compound. Special care has been taken in the design of the spout insulators to obtain a smooth potential gradient on the inside edges and to avoid brush discharge.

The busbar chambers are built accurately to jigs in order to ensure that the fixing holes and faces occupy definite positions relative to the spout contacts. Steel doors are arranged to close automatically over the contact receptacles as soon as a truck is withdrawn.

On the movable truck, the plug contacts are of the cylindrical self-aligning pattern, allowing free movement in two planes and ensuring that there is good and true engagement of the contacts. The connections to the circuit-breaker terminals consist of hard-drawn copper, mounted in a welded sheet-steel trough filled with compound.

The oil circuit-breaker, which is mounted on the movable truck, has been specially designed to avoid the use of a top frame casting. A separate tank is provided for each phase, and the tanks are rigidly bolted to a sheet steel top plate, which also carries the connection troughs previously mentioned. Leading-in insulators of the usual type support the main contacts, the latter being of the reverse laminated brush pattern, designed so that an increased current will augment the contact pressure. The sparking tips are of an improved blow-out pattern, having a very high breaking speed. The amount of air buffer above the oil, the head of oil over the break, and the length and speed of break have been carefully proportioned to give the requisite breaking capacity for minimum space occupied.

The operating mechanism is of the free-handle type and is simple in construction, while the handle has a

large angular travel, enabling the breaker to be closed without appreciable effort.

The current transformers are of the oil-immersed type, mounted alongside the oil circuit-breaker, but it is understood that extension equipments now on order will be of the compound-filled type, being mounted in the steel trough connection chambers over the circuit-breaker. The primary and secondary coils are separately wound and insulated for the full working voltage between coils. The transformers are designed to withstand the maximum voltage and temperature rise which may be reached should the secondary winding be accidentally open-circuited. In the case of compound-filled transformers, provision is made so that a complete compounded element can be readily interchanged with one of a different ratio.

The connections and plugs for the circuit side of the circuit-breaker are generally as described above for the busbar side.

The cable dividing box, which is mounted above and behind the busbar chamber, is of the split type, arranged so that either half can be removed, while jointing can be done and access obtained from the front or rear of the gear as desired. Split sleeve connectors are provided for receiving the cables and porcelain bushings taking the conductors to the plug receptacles. Glands for lead-covered cables and armouring clamps are fitted where necessary.

Where required, potential transformers of the oil-immersed type are mounted above the fixed element in a steel tank. This tank is provided with a removable lift-off lid, and the e.h.p. protective fuses are secured to this part. The connections from the main circuit to the fuses are carried through compound-filled metal pipes bolted together and fitted with spring plugs at each end.

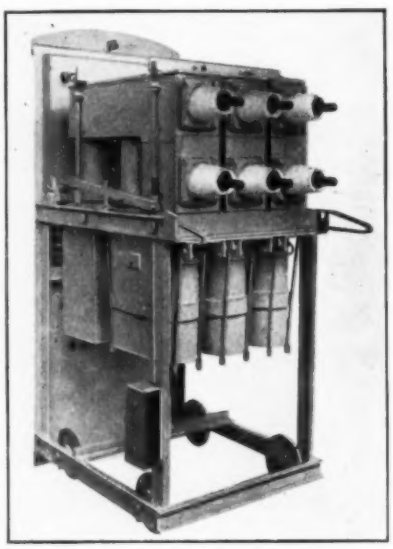


FIG. 3.—TRUCK WITHDRAWN.

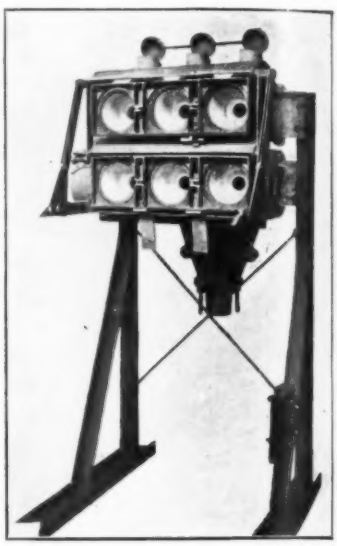


FIG. 4.—BUSBAR ELEMENT.

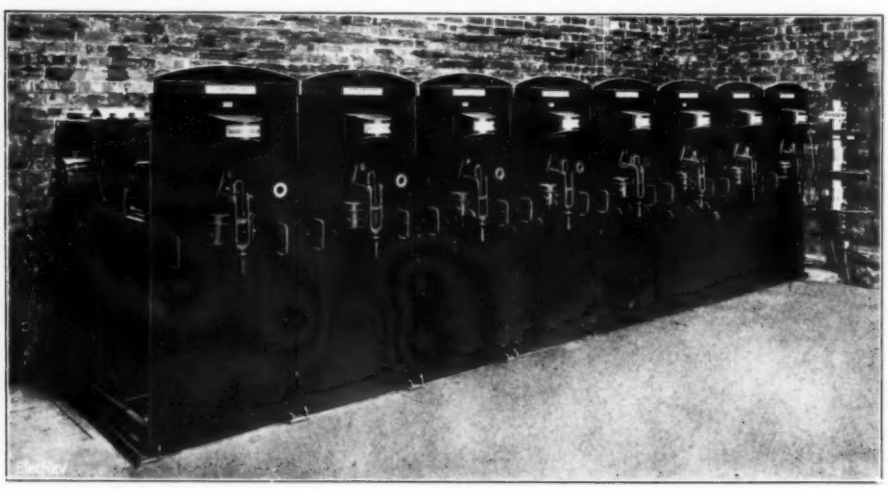


FIG. 2.—SWITCHGEAR IN NEW SOUTHGATE SUB-STATION.

forming isolating links which must be removed before access can be gained to the potential transformer or the fuses.

Spring covers are provided for the plug contacts to the main connections, and these covers close automatically when the plugs are withdrawn, so that a fuse can be readily and safely replaced without shutting down the main circuit.

Special care has been taken to provide simple and robust interlocks to ensure that the operations are carried out in the correct order, and to shield the operator from accidental access to live metal.

Starting with the removable truck in the closed position:—

1. The truck is mechanically locked in position, and can only be withdrawn by the withdrawing lever mounted on the front of the truck.

2. Should the operator attempt to withdraw a truck while the oil circuit-breaker is closed, the truck withdrawing lever rotates a cam and releases the oil circuit-breaker before the plug contacts separate.

3. The withdrawing lever removes the truck sufficiently far from the stationary portion to provide complete isolation of the truck. The oil circuit-breaker can then be operated quite freely, but the truck must be withdrawn further by hand if it is desired to remove the tanks and inspect the contacts. This further motion automatically closes sheet-steel covers over the plug contacts on the stationary portion of the equipment, thus completely shutting off all live metal.

4. Provision is made for padlocking the oil circuit-breaker in the open position and the truck in the withdrawn position; similarly, provision is made for padlocking the shutters over the plug contacts in the closed position.

When returning the truck to the closed position:—

5. The truck cannot be put back in position until the oil tanks are in position.

6. The truck cannot be pushed home without the use of the closing lever, even if the latter is first put in the closed position.

7. The shutters over the plug contacts are automatically opened as the truck is put back into position.

8. Should an operator omit to open the oil circuit-

breaker before putting the truck in position, the truck closing lever releases the oil circuit-breaker before the plug contacts engage.

9. When isolating a potential transformer, automatic shutters close over the plug contacts when the metal-clad connectors are removed, and these shutters can be padlocked in the closed position.

A separate earthing device can be fitted to either set of contacts on any movable truck, for earthing either the cable or busbars as desired. This device consists of a steel bar having mounted on it three brass receptacles to suit the plug contacts on the truck, and also a copper earthing plug on the bar for connecting to a receptable in the fixed metal framework.

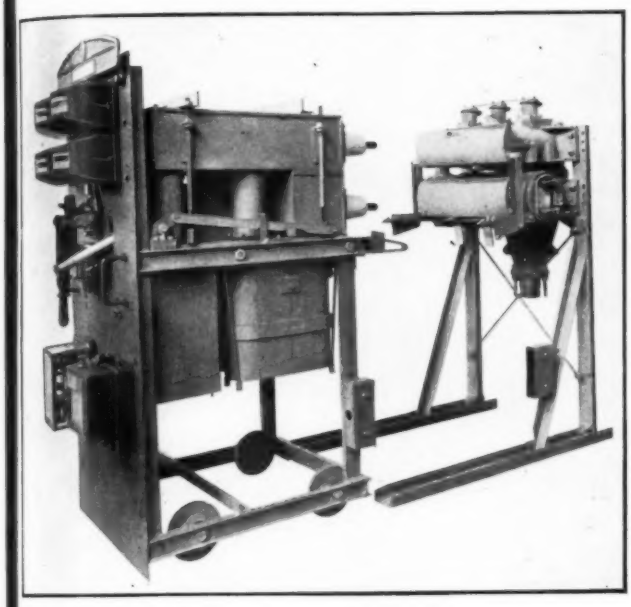


FIG. 5.—COMPLETE PANEL, OPEN, SHOWING SHUTTERS OVER STATIONARY CONTACTS.

Three loose extension adapters are provided for fitting to the other set of plug contacts to obtain engagement with the receptacles in the fixed unit when the movable truck is run into contact. Earthing is then completed by closing the oil circuit-breaker.

It will be seen from the foregoing that rolled steel and sheet metal has been very largely employed in place of castings. All compounded chambers, with the exception of the cable dividing boxes and the busbar joints between equipments, are filled with compound at the factory before dispatch. The chambers are designed to simplify the process of filling, and to avoid the formation of air pockets. Ample thickness of compound is provided to furnish a large safety factor, and where phase connections pass each other, as in the busbar chamber, the conductors are also insulated for the full voltage with cambric insulation.

In direct-operated equipments the instruments and oil circuit-breaker operating handle are mounted on a sheet steel panel, which also serves as an effectual screen for the operator when the breaker has to perform heavy duty.

The equipment for the New Southgate sub-station consists of an eight-panel switchboard, as shown in fig. 2. This equipment, also supplied by the British Thomson-Houston Co., Ltd., is of the same type as that mentioned above.

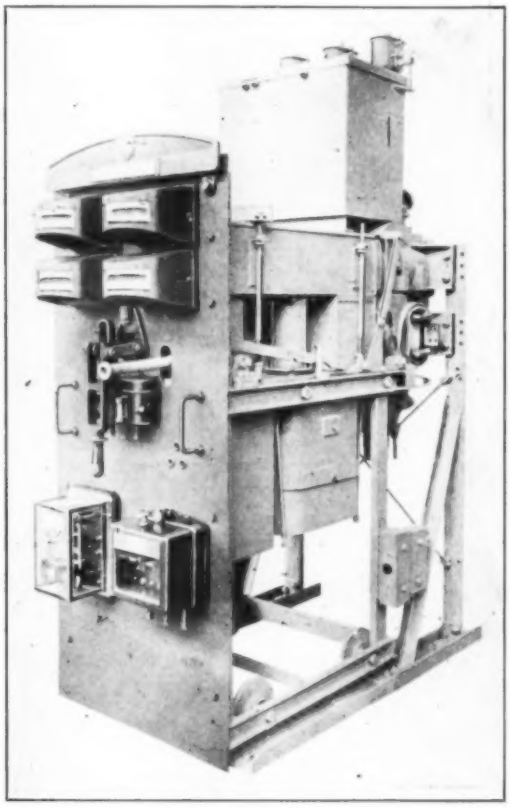


FIG. 6.—PANEL CLOSED.

We are indebted to Mr. J. M. Donaldson, chief engineer of the N.M.E.P.S. Co., for permission to publish these details.

ELECTRICITY SUPPLY IN INDIA.

THE United Provinces Electric Supply Co. has generating stations at Lucknow and Allahabad, and is contemplating the installation of electricity works in other towns in the Provinces. The original licences for Lucknow and Allahabad were held by Messrs. Crompton and Co., Ltd., but were taken over in 1915 by Messrs. Martin and Co., the well-known contractors of Calcutta, who then formed the United Provinces Electric Supply Co., and retained Messrs. Handcock & Dykes as consulting engineers to the company, which position they still hold. The original proposals were considered and amended by Messrs. Handcock & Dykes, and orders for the plant were placed in August, 1915.

The original plant at each station consisted of one 85-h.p. Hornsby crude-oil engine, directly coupled to a Crompton d.c. 440/540-volt generator, and two similar sets of 200-kW capacity each, together with a battery of 260 cells of 660-Ah capacity, supplied by the D.P. Battery Co. Each station was equipped with two Heenan and Froude coolers, a 10-ton overhead crane by Messrs. Morris & Bastert, two balancers capable of dealing with 75 amps. out of balance, and three 150-A 0-100-V motor boosters, one being a spare set.

Unfortunately, owing to the war, the larger engines were commandeered by the Government, and only the small 85-h.p. Hornsby set reached India, together with the rest of the station plant. Although the company and its advisers were exceedingly averse to commencing the supply under these conditions, considerable pressure was brought to bear upon them by Government and other authorities, with the result that supply was commenced in 1917 with this plant, together with second-hand temporary steam plant which had previously more than done its duty at Calcutta.

This temporary steam plant, in addition to being exceedingly expensive (the sets were condensing sets, but were run non-condensing owing to a lack of water), repeatedly broke down, and as there was at the same time very great difficulty, owing to the war, in getting suitable staff (the original engineers sent out by Messrs. Handcock & Dykes having joined up), the company ran its station for the first year or two under serious difficulties.

As soon as possible after the end of the war, four new 200-kW sets were put in hand, and the first of these was put to work at Lucknow in February, 1920; another was started in May, 1920, at Allahabad, the other sets being put into commission in July and November, 1920, respectively. As soon as the proper plant was at work, rapid progress was made, as will be seen from the appended statement of kWh sold and consumers connected.

At the end of 1921 an additional set was installed at Lucknow—this being of the Ruston & Hornsby cold-starting type, of 320 b.h.p. at 170 r.p.m., coupled to a Crompton 200-kW dynamo, 500/540 volts—and a similar set is now being installed at Allahabad. Before dispatch, these sets were tested for 48 hours at the makers' works by the consulting engineers, the result of the test being as given below, from which it will be seen that these engines are of an exceedingly economical type, working at a lower fuel consumption even than the ordinary "full Diesel" engine.

Unlike the original Hornsby heavy-oil engine, the Ruston cold-starting type can be started instantly from rest by means of compressed air, and can be operated at any load from zero to full without any hand regulation, and, of course, without any blast regulation—this being a valuable feature distinctive of this type of engine.

The engine is of the Ruston airless-injection type, in which, as will be seen from fig. 2, the beds are bolted together, and both the air and exhaust valves are driven by one eccentric from the sideshaft. Fig. 1 is an end view of a gear similar to that fitted to the engine in question.

The engine is capable of developing for short periods a maximum output of 380 b.h.p. The pistons are not water cooled, and even after long runs at the working load show no signs of overheating. The engine works on a four-stroke cycle, and the compression temperature

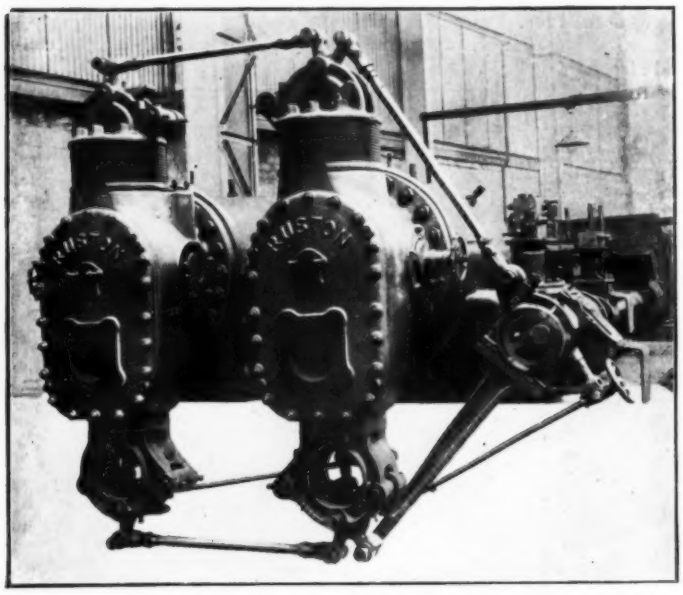


FIG. 1.—AIR AND EXHAUST VALVE GEAR OF RUSTON OIL ENGINE.

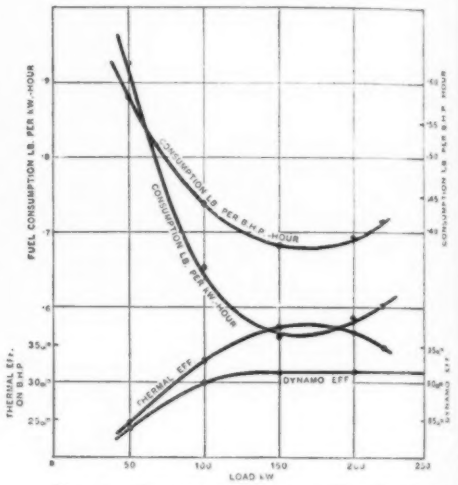


FIG. 3.—RESULTS OF 48-HOUR TEST RUN.

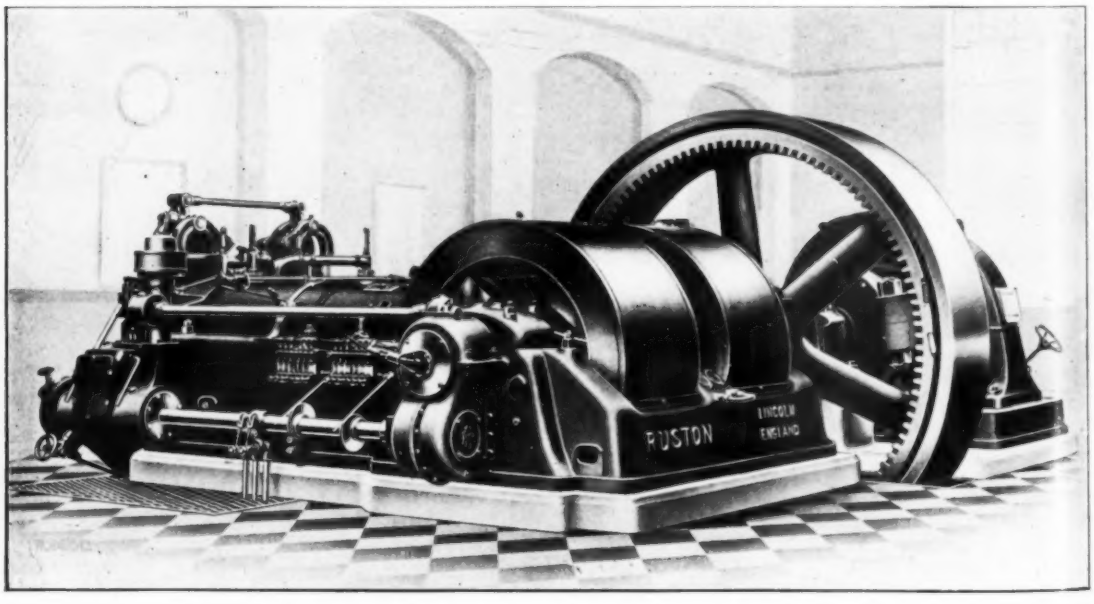


FIG. 2.—RUSTON COLD STARTING OIL ENGINE AND DYNAMO.

is sufficient to ignite the oil, which is injected into the cylinder by a pump and divided into a fine spray by the company's patent atomiser.

The 48-hours' continuous test was carried out with a load distribution as indicated below; the results are shown in fig. 3, and fully corroborate the consumption that has been obtained with a similar set under working conditions in India, namely, 0.6 lb. per kW-hour.

The actual figures obtained on test were as follows:—

Load kW	Duration of test Hours.	Fuel in lb. per kW-hour.	Dynamo efficiency per cent.*	Fuel, lb. per b.h.p.-hour.
50	4	0.92	84	0.58
100	4	0.65	90	0.44
150	4	0.56	91	0.38
200	34	0.58	91	0.39
220	2	0.6	91	0.41

* Obtained by test at makers' works.

Two engines of this size have recently been installed to the specification of Messrs. Handcock & Dykes for the Douglas Corporation, Isle of Man.

To meet the increasing demands for electricity at a considerable distance from the works, it has now been decided, whilst keeping d.c. for the area nearest the station, to transmit energy by means of 3,300-V, 3-phase alternating current to the outlying districts, and an order has just been placed with Messrs. Ruston and Hornsby, Ltd., for two vertical cold-starting 4-cylinder crude-oil engines of 400 h.p. each, whilst Messrs. Crompton & Co. are supplying two tandem sets, each consisting of one 140-kW, 3,300-V, 3-phase flywheel alternator and one 150-kW, d.c. generator, it being the intention to add two similar engines, each coupled to a flywheel alternator, next year.

The company is now paying good dividends, and, with the addition of the high-pressure plant, progress is sure to be rapid. It was formed in the year 1915 with an authorised capital of Rs.15½ lacs, of which Rs.14 lacs was subscribed. Additional capital amounting to Rs.20 lacs has been raised for the contemplated extensions. It is expected that the present dividend of 8 per cent. per annum will be considerably improved upon when the new plant comes into operation. The following figures show the steady progress of the company's business:—

Year ended March 31st.	kWh sold.	Gross revenue.	No. of consumers.	Maximum load kW.
1918	265,823	Rs.92,312	365	190
1919	479,100	1,75,352	464	310
1920	599,131	2,22,194	689	342
1921	867,174	3,43,680	921	535
1922	1,302,763	5,58,729	1,108	725
1923	1,822,885	6,96,146	1,349	878

LIGHTING AND POWER NOTES.

(*Continued from page* 138.)

Portsmouth.—YEAR'S WORKING.—The income of the municipal electricity undertaking (engineer: Mr. B. Handley) during the year ended March 31st last was £133,637, an increase of about £10,000. The working expenses decreased from £85,966 to £83,102, leaving a gross surplus of £50,535, as against £37,790 in 1921-22. Capital charges were rather higher, but the net result was a profit of £23,974, as compared with £15,740 in the previous year. This profit was allocated as follows:—Reserve fund, £13,974; contributed to rate relief, £10,000. The capital account shows a total expenditure during the year of £44,551, the two principal items being £30,769 for machinery and £20,183 for mains and services. The amount of energy sold was 6,190,000 kWh, an increase of 975,862 kWh. The report mentions the difficulty which has been experienced in carrying on with old plant, but it is also stated that the good progress made enabled the extensions to be inaugurated in January last.

Portuguese West Africa.—HYDRO-ELECTRIC DEVELOPMENT.—According to the recently-issued report of H.M. Consul-General at Loanda, the falls and rapids on most of the rivers of Angola are believed to have considerable possibilities as sources of water power. Several concerns have obtained licences during the last two years to make preliminary surveys on different rivers. The Sociedade Agricola Industrial de Angola is studying the possibilities of the River Cuvo, in the Amboim region; the Companhia de Cabinda is surveying the rapids of the River Luall, in the Cabinda Enclave; and another Portuguese concern is making investigations on the River Zenza, inland from Loanda. The Benguella Railroad Co. has a licence to study the falls on the River Cuando, and the Fomento Geral de Angola is investigating the possibilities of the Capangula Falls on the River Cuchi. In the Benguella district the Catumbella River is being dammed by a Portuguese concern.

Preston.—NEW POWER STATION.—The Electricity Committee has considered the revised estimates for the erection and equipment of the Ribble power station, the expenditure upon which amounts to £409,510, plus £74,826 for transmission lines, sub-stations, mains, &c., and has recommended the Council to approve of these estimates.

Rugby.—PRICE REDUCTIONS.—The Urban Council has reduced the charges for electricity as under:—Lighting: First 500 kWh per quarter, 5½d. per kWh; 500 to 1,000, 5d.; 1,000 to 1,500, 4½d.; beyond, 4d. Domestic heating and cooking: 2d. per kWh, with a minimum charge of 5s. per quarter. Power: 2d. per kWh, with a minimum charge for 60 kWh per quarter per h.p. installed.

Swansea.—CHANGE-OVER.—The Borough Council has decided to change over its system of electricity supply from direct to alternating current.

LOANS.—Application is being made to the Electricity Commissioners for sanction to the borrowing of £20,000 for mains, £10,000 for services, and £13,132 for boiler plant.

Skipton.—ELECTRICITY SUPPLY.—After prolonged negotiations with the Yorkshire Electric Power Co., it is reported that a special meeting of the Keighley Town Council has been called, when the Electricity Committee will recommend "that an agreement between the Corporation and the Yorkshire Electric Power Co. for the supply of electricity in bulk at Eastburn, for transmission by the company to the Skipton Urban District Council, be approved."

Tring.—ELECTRICITY SUPPLY.—The Urban Council has received a letter from the Aylesbury Corporation stating that it has under consideration the question of extending its area of electricity supply so as to include Tring. The Urban Council has decided to confer with representatives of the Corporation on the subject.

Truro.—ELECTRICITY SUPPLY.—The Town Council has adopted the recommendation of the Electricity Committee, accepting the offer of the Cornwall Electric Power Co. for the supply of electricity. The charge is to be 1s. per kWh, the company is to be allowed to use overhead wires within the city boundaries, and the Town Council is to contribute the sum of £4,500 towards the cost of installing 300 street lamps. The company is to supply electricity to 300 60-W street lamps for £2 2s. per lamp per year.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—One of the first of the major projects to be constructed and placed in service under the provisions of the Federal Water Power Act is the Coosa River project of the Alabama Power Co. The licence was issued in June, 1921, and in April, 1923, the first set of 24,000 h.p. was put into operation at Mitchell Dam. Other hydro-electric developments on the Tallapoosa and Coosa Rivers are also proposed by the Alabama Power Co., which has on file with the Commission applications aggregating 235,000 h.p. The company now operates more than 1,250 miles of transmission line and serves a population estimated at 550,000.—*N.E.L.A. Bulletin.*

York.—INAUGURATION OF NEW STATION.—Princess Mary, Viscountess Lascelles, who will be accompanied by her husband, has agreed to perform the formal opening ceremony at the Linton Lock hydro-electric power station on August 1st. It is anticipated that at the next Council meeting the Electricity Committee will recommend that the plant at the generating station at Foss Islands Road be discarded.

TRAMWAY AND RAILWAY NOTES.

Bradford.—PROPOSED NEW ROUTE.—The Tramways Committee has received a letter from the Clayton Urban District Council, asking the Corporation to arrange a service to Clayton, *via* Pasture Lane, of either tramway or railless cars or motor-'buses. The Committee has agreed to meet representatives of the Clayton Council.

WEEKLY PASSES.—During the few weeks the system of weekly "passes" has been in operation as a trial on the Lidget Green tramway route, the scheme has proved a success, and the Tramways Committee has now decided to extend the facilities to the Thornton, Allerton, and Duckworth Lane routes, on trial till October 31st. The receipts on the Lidget Green route each week have been much in excess of the basic average during the preceding three months.

Continental.—FRANCE.—The Municipal Council of Paris has decided upon the construction of the Montparnasse-Porte de Vanoes line of the North-South underground electric railway. According to the conditions of the new agreement between the city and the company, which was brought into operation in January, 1921, this line has to be built at the cost of the city, and the company will probably issue a loan for the account of the city in order to defray the outlay. As in the case of the Metropolitan Railway Co., the North-South Railway Co. is now merely an operating company

which receives a share in the working results and a premium for economical working.

AUSTRIA.—The formal opening of the first electrified portion of the Arlberg railway line between Innsbruck and Telfs, a distance of 17 miles, took place on July 22nd.—*Financial Times.*

SPAIN.—The first electric mountain railway in Spain was opened on July 13th by King Alfonso. This line, which is seven miles long, starts from Cercedilla, a village on the Madrid-Segovia Railway, and rises to a height of 5,700 ft. near the Navacerrada Pass. The enterprise has taken four years to complete.

Edinburgh.—NEW ROUTES.—The Tramways Committee proposes to lay down tramways between Seafield, Leith and Portobello.

London.—L.C.C. TRAMWAYS.—The Highways Committee of the London County Council recommends that the necessary power for working increased services in the Tooley Street area be purchased from the Bermondsey Borough Council, which has a power station in the district. An estimated expenditure of £4,350 is involved, made up as follows:—Switchgear, £500; ductwork, £250; cable alterations, £3,500; and removal and re-erection of switchgear, £100.

London, Midland and Scottish Railway.—ELECTRIFICATION.—The London, Midland, and Scottish Railway Co. is reported to be contemplating the electrification of the main West Coast route from Preston to Carlisle, a distance of nearly 90 miles, and is building an experimental electric locomotive for the purpose. It is understood that the overhead conductor system will be used.

Manchester.—NEW ROUTE.—The Tramways Committee proposes to construct a new tramway at Moss Side.

Newport (Mon.).—TRACK RENEWALS.—The Town Council has received the sanction of the Ministry of Transport to the borrowing of £14,391 for track renewals.

Southern Railway.—ELECTRIFICATION.—The London Electric Supply Corporation has made application for a Special Order authorising it to supply electricity for the working of the electrified portions of the Southern Railway.

Southport.—YEAR'S WORKING.—The report of the general manager of the Corporation tramways (Mr. T. J. Kendrew) for the year ended March 31st last shows that the total income was £78,203, as compared with £78,944 in the previous year. The working expenses totalled £51,331, as against £51,243, leaving a gross surplus of £26,872 (£27,701). As the capital charges were lower, the net profit increased from £1,901 to £4,037. The number of car-miles run increased from 812,420 to 841,871, and the number of passengers carried from 9,266,712 to 9,303,009. The income per car-mile decreased from 23.321d. to 22.294d., and the total expenses from 19.679d. to 17.151d. per car-mile.

Sweden.—RAILWAY ELECTRIFICATION.—Preparations for the electrification of the railway between Stockholm and Gothenburg are now in hand. Eighteen hundred tons of copper, valued at kr. 3,000,000, have been ordered from Svenska Metallverken, Finspongs Metallverk, and Helsingborgs Metallverk. All the tenders for poles to carry the line have not yet been received. It was originally intended to manufacture these poles of iron, but owing to a dispute at the ironworks, reinforced concrete will eventually be used unless the conflict is settled immediately. Tenders for 50 electric locomotives invited from 12 Swedish firms have not yet been sent in, the firms in question having asked for a postponement until September 1st. The work of electrification is to be carried on during October and November; it will cease during the winter months and be resumed in April.—*Reuter's Trade Service* (Stockholm).

TELEGRAPH & TELEPHONE NOTES.

India.—DELHI TELEPHONE SYSTEM.—The laying of the 60 miles of cable required for the telephone system in the new Delhi will be commenced shortly. The automatic exchange at the new city will be designed for a maximum capacity of 3,000 subscribers. The initial capacity will be for 1,500 subscribers. Later it is intended to provide a similar exchange for Delhi itself.—*Reuter's Trade Service* (Bombay).

Irish Free State.—AUTOMATIC TELEPHONES.—The Irish Free State Post Office Department has secured the services of one of the best automatic telephone experts in the British service. This official is an Irishman, and his function will be to tackle the whole system of automatic telephones.

Wireless and Telegraphic Conference.—A committee, consisting of the directors of the British, French, and Italian Telegraph Services, met at the London office of the League of Nations on July 16th and 17th in order to examine, in conformity with a request by the Council of the League, a proposal put forward by the Italian Government for an international conference on radio-telegraphy. The members of the committee declared themselves unanimously in favour of a universal conference, at one and the same time telegraphic and radio-telegraphic, which should be held in the first half of 1924. As negotiations have been in progress for some time between certain Governments for the holding of such a conference, the committee proposes to meet in October next to re-examine the proposal of the Italian Government that this conference should be held with the co-operation of the League of Nations in case the above-mentioned negotiations have not met with success by that date.—*Reuter.*

RADIO-TELEGRAPHY AND TELEPHONY.

Empire Wireless Communication.—A deputation from the Empire Press Union, headed by Lord Burnham, interviewed the Postmaster-General on Monday last with regard to the importance of hastening the provision of adequate wireless communication with the Dominions, in order that the cost of telegraphing news might be reduced. According to *The Times*, Lord Burnham said the Empire Press Union believed that the work could best be done by private enterprise; the years were passing, but nothing happened. In reply, the Postmaster-General agreed with regard to the importance of the wireless service, and said that applications for licences had been received from a cable company and from the Marconi Co. The former wished to communicate with Ind which unfortunately had not made up its mind whether to set up a Government station or to grant a licence to private enterprise. He hoped that the terms of the Marconi Co.'s licence would be settled in a few weeks. The Post Office had ordered the masts for its high-power station at Rugby, which should be in operation in about a year's time. The basis of the licences was a joining of private enterprise with a minimum of Governmental control. The Oxford station was now used to a considerable extent for outgoing messages. The wireless tariff would always be fixed at lower rates than the cable rates.

France.—CENSORSHIP OF BROADCAST NEWS.—A censorship of broadcast programmes to ensure that no false or tendencious news, particularly with regard to Bourse or market transactions, be circulated, is proposed in France, according to the *Evening News.*

REVISED REGULATIONS.—By the new regulations regarding private transmission and reception, receiving stations are divided into three categories, says the *Morning Post*: Stations installed by public bodies for giving free lectures, concerts, &c.; private stations which give public concerts; and purely private receiving sets. Receiving sets must be registered at a post office, and a registration fee of one franc will be charged; foreigners must obtain a special permit from the Under-Secretariat for Posts and Telegraphs. Owners of private stations used for a public purpose must pay a yearly tax of 200 francs.

Special permits must be obtained for transmitting stations, which are divided into five categories: (1) Fixed stations for private communication; (2) fixed stations for communication of general interest; (3) movable stations corresponding with these two categories for private news; (4) experimental and scientific stations; (5) stations belonging to amateurs. Everything transmitted by private stations comes under the law of 1850 regarding private telegraphic correspondence. Stations coming under the second category may only transmit artistic and educational matter and general news having no personal character, all advertising being excluded. Information which has not a purely artistic, scientific, or educational character can only be transmitted if it is to be published in a periodical fulfilling the conditions of the law of 1881, this publication not to free the owner of the station from responsibility for the information transmitted. Moreover, owners of stations coming within the second category must devote one hour daily to the transmission of news, both official and of general interest, communicated by the postal administration. They must keep a record of everything transmitted by their stations. The decree provides many regulations of a technical nature, including the wave-lengths for the five different categories of transmitting stations, which are as follows:—(1) 150 to 200 metres for telegraphy and telephony; (2) 200 to 280 metres telegraphy, 200-230 and 350-425 metres telephony; (3) 150-180 metres; (4) variable according to aim in view; (5) 180-200 metres. Special permission must be obtained to transmit messages in any other language than French. Private transmitting stations will be subject to a tax of 100 francs per year per kilowatt, plus certain additional taxes. Permits may be revoked.

Mexico.—RADIO-TELEGRAPHY.—The Mexican Government intends to change the apparatus in use in its radio stations from the present spark to the continuous-wave type, according to a report from the Director-General of Telegraphs. It is said that four modern stations of this class have already been ordered from Germany at a cost of $200,000. They are to be installed in Mexico City, Merida, Vera Cruz, and Tampico. Stations of the old spark type which already exist at these points are to be transferred respectively to the Islas Marias, in La Paz, Lower California; Guadalajara, Jalisco; and Acapulco, State of Guerro. With the spark system, the Government has been able to communicate only with Nauen, Germany, and with the Lafayette station at Bordeaux, France.—*Commerce Reports.*

Radio-Broadcasting.—NEW STATIONS.—It is hoped to open the Aberdeen station at the end of August; the new stations at Birmingham and Manchester at the beginning of August, and a station at Bournemouth soon. According to *The Times*, Lord Gainford, chairman of the B.B.C., recently announced that within 30 miles of the existing stations there was a popu-

lation of 28,000,000, and, with the completion of the eight stations within a few weeks, 31,700,000 would be brought within a 30-miles receiving radius. Subject to permission from the Post Office, they intended to construct a certain number of relay stations in certain areas where industrial populations, by distance or through "screening," were not receiving the results of the existing transmitting stations. If they were able to construct 11 relay stations, they would be in a position to transmit the broadcast programmes to 75 per cent. of the total population of Great Britain. The scheme for new stations, says the *Evening News*, includes Liverpool, Sheffield, Leeds, Bristol, Hull, Bradford, Nottingham, Portsmouth, Stoke-on-Trent, Leicester, Plymouth, and Edinburgh.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Audenshaw.—July 30th. Electric lighting installation at St. Stephen's Church. Specifications (£1 1s., returnable) from D. C. Rolls, hon. sec., Church Council, 59, Audley Street, Cockbrook, Ashton-under-Lyne.

Australia.—MELBOURNE.—October 24th. Victorian Government Railways. Two one-ton electric hoists with trolley wires and current collectors.—*Reuter's Trade Service* (Melbourne).

Victorian Electricity Commission. October 6th. Specification No. 23/117, 22,000-V insulators in connection with the Morwell power scheme. (July 20th.)

COMMONWEALTH GOVERNMENT.—Various dates. Cable distributing terminals; bells, cords, and plugs; switchboards; telephone parts; motor-generator sets; and submarine cables. (See this issue.)

SOUTH AUSTRALIA.—September 18th. Harbours Board Four 7-ton electric travelling coal-unloading cranes.—*Reuter's Trade Service* (Melbourne).

Belgium.—Tenders have been invited by the municipal authorities of Bassenge (Province of Limbourg) for the concession for the distribution of electrical energy for lighting and power purposes in the town.

Municipal authorities of Mazée (Province of Namur). Establishment of an electricity supply system in the town.

July 31st. Municipal authorities of Looz (Province of Limbourg). Establishment of a low-pressure electricity distribution system in the little towns of Looz, Grand-Looz, Kerniel, Gors-op-Leeuw, Wintershoven, and Wimmertingen.

August 1st. The Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels, are inviting tenders for the supply of 77,000 metres of specially-insulated bronze wire, in five lots. Particulars for 1 fr. (Cahier des Charges Special No. 1262).

Bradford.—August 16th. Corporation. Supply and erection of two 1,000-kW rotary or motor converters. (See this issue).

Bristol.—August 1st. Electrical Committee. Self-cleaning water-screening plant (2¼ million gal. per hour capacity). (July 13th.)

Canada.—TORONTO CITY COUNCIL.—August 21st. The Council is inviting tenders for the supply and installation, at the Strachan Avenue sewage-pumping station, of two 2,880,000-gal. centrifugal sewage pumps, direct-connected to 3-phase induction motors.*

Doncaster.—August 6th. Electricity Department. One 1,250-kW rotary converter and l.p. switchgear. (July 20th.)

Dublin.—July 30th. Electricity and Public Lighting Committee. Supply and erection of transformers during a period of one year. Tenders, enclosing one guinea, must be sent to the Town Clerk and Secretary to the Committee, Fleet Street, Dublin.

Two oil coolers to be used in connection with the steam turbine plant at Pigeon House Electricity Works.

Eccles.—August 4th. Electricity Department. Two 200-kW sets for converting 6,600-V, 3-phase a.c. to d.c. at 550 V. (July 20th.)

Edinburgh.—September 3rd. Electricity Department. Supply and erection of a 33,000-V overhead main transmission line. (See this issue.)

France.—PARIS.—French War Office. Supply of 30 km. of single-wire four-circuit telegraph cable and 30 km. of single-wire double-circuit ditto.

Glasgow.—August 2nd. Electricity Department. Various works required in connection with erection of joiners', painters', and general workshops at Dalmarnock power station. Forms, &c., from electrical engineer.

33,000 tons and 150,000 tons, more or less, of coal (singles and pearls) for the electricity generating stations. Forms &c., from Mr. R. B. Mitchell, engineer, 75 Waterloo Street.

Grays.—July 31st. Electricity Department. Two 350-kW converting sets, with two 400-kVA static transformers, and switchgear. (July 13th.)

Greenock.—July 28th. Corporation Electricity Department. Erection of overhead transmission lines between the Greenock and Paisley power stations, &c. (July 20th.)

Grimsby.—September 4th. Electricity Department. One 3,000-kW turbo-alternator, with condenser, pipework, motor-driven auxiliaries, &c. (See this issue.)

Hazel Grove and Bramhall.—August 20th. Urban District Council. Three-phase, four-core, lead-covered and armoured cable; l.p. sub-station switchgear; and a.c. electricity meters. (See this issue.)

Leeds.—September 3rd. Electricity Department. Supply and erection of 3-phase switchgear. (July 20th.)

London.—L.C.C. TRAMWAYS.—August 13th. Supply and erection of pipework and de-aerating plant at Greenwich power station.

New Zealand.—August 21st. Public Works Department. Supply of a steel runway for a crane at Khandallah sub-station, section 84, Mangahao. The amount of deposit is £25, and the amount of bond £35. Sealed tenders are to be lodged with the Secretary, Public Works Tenders Board, Wellington.*

AUCKLAND.—August 9th. Municipal Tramway Department Two miles 7/12 galvanised steel span wire; 1 mile No. 12 h.d. copper wire; 2 miles 37/.083 triple-braided aerial cable; 500 yards 37/.083 lead-sheathed cable, joint boxes, &c.; and 12,000 ft. of glazed earthenware troughing. Particulars and specifications from Downie Bros., 7, Fenchurch Avenue, E.C.3.

Salford.—July 30th. Ten covers for tramcars. Particulars from general manager, Tramways Department, 32, Blackfriars Street, Salford.

Sheffield.—July 30th. Electric Supply Department. Contract No. 317. Laying 6-in. c.i. socket and spigot pipes, valve, strainer, concrete stools, manholes, &c., for conveying water along Club Mill Lane, Neepsend. Form of tender and specifications (£2 2s.) obtainable from Mr. S. E. Fedden, general manager and engineer, Commercial Street, Sheffield.

South Africa.—CAPETOWN.—August 3rd. Municipal Council. House-type direct-current, watt-hour meters:—600 for 10A, 220 V; 50 for 25 A, 440 V; 25 for 50 A, 440 V; 10 for 100 A, 440 V; also spares.—*Reuter's Trade Service* (Capetown).

JOHANNESBURG.—August 8th. Municipal Council. Field coils for traction motors.*

Southend-on-Sea.—July 30th. Town Council. Electric lighting installation, at Leigh Council offices. Mr. R. H. Dyer, borough engineer (returnable deposit of £1).

Spain.—Cartagena Harbour Authority. Tenders are invited for the supply of four electric cranes, four electrically-operated capstans, and the necessary plant for converting three-phase current to d.c.

Warrington.—August 11th. Supply of three electrically-driven centrifugal pumps, for Waterworks Department. Deposit £1 1s. (returnable). Particulars from Mr. J. Gray, waterworks engineer, Municipal Offices, Warrington.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The municipal authorities of Antwerp have placed a contract with the Société des Ateliers de la Biesme, of Bouffioulx, Chatelineau, for the supply and installation of 15 large electric cranes at the Antwerp docks.

Bexhill.—Town Council. Accepted:—

Erection of building (£2,345) and construction of engine beds, &c. (£595), in connection with new generating station at Little Common.—Strange and Sons, Ltd.

Bradford.—Electricity Committee. Accepted:—

Provision of a transformer chamber at Town Lane, Idle.—J. & P. Obank.

Tramways Committee.

Supply of 100 steel tramcar tires (£297 10s.).—The Steel Co. of Scotland, Ltd.

Supply of an overhead runway and lifting blocks at Thornbury depôt (£138).—Herbert Morris, Ltd.

Dublin.—*The Irish Builder and Engineer* reports that the Sackville Press, Ltd., has accepted a tender of £948 from A. G. Bruty for the installation of motors at its works. The contract for wiring the works has been awarded to R. McLean & Co.

Government Contracts.—The following Government contracts were placed during June, 1923:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Batteries.—D.P. Battery Co., Ltd.
Electric capstans.—Cowans, Sheldon & Co., Ltd.
Coils.—H. W. Sullivan, Ltd.
Control boards.—General Electric Co., Ltd.
Revolving jib cranes.—T. Smith & Sons (Rodley), Ltd. Sub-contract for motors: Metropolitan-Vickers Electrical Co., Ltd.
Electrodes.—Quasi-Arc Co., Ltd.
Insulating material.—Ioco Rubber and Waterproofing Co., Ltd.; Ed. Macbean & Co., Ltd.; Mica Manufacturing Co., Ltd.; Mica and Micanite Supplies, Ltd.; R. Whiffen, Ltd.; H. Clarke & Co. (Manchester), Ltd.; Butterfield & Renton; Attwater & Sons.
Motor alternators, &c.—Crompton & Co., Ltd.; Newton Bros. (Derby), Ltd.

Electric travellers.—Sir W. Arrol & Co., Ltd. Sub-contractors for motors: Laurence, Scott & Co., Ltd.

AIR MINISTRY.

Magnetos and spares.—British Thomson-Houston Co., Ltd.
Motor-generators, starters, transformers, &c.—W. Mackie & Co.
Sparking plugs.—Robinhood Engineering Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Alternator spares.—Metropolitan-Vickers Electrical Co., Ltd.
Copper wire, &c.—Shropshire Iron Co., Ltd.
Meters, &c.—Ferranti, Ltd.
Telegraph line materials.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Telephone switchboard, &c.—British L. M. Ericsson Manufacturing Co., Ltd.
Telephone cable.—British Insulated & Helsby Cables, Ltd.

POST OFFICE.

Telegraph apparatus.—Murray Printing Telegraph Systems (Donald Murray).
Telephone apparatus.—Automatic Telegraph Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); Phœnix Telephone and Electric Works, Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Testing, protective apparatus, &c.—British L. M. Ericsson Manufacturing Co., Ltd.
Radio apparatus.—General Electric Co., Ltd.; Western Electric Co., Ltd.
Battery boxes.—Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Ediswan Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Macintosh Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; The Receiver, H. W. Smith and Co. (1920), Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Secondary cells and parts.—Accumulators of Woking, Ltd.
Loading coils.—Western Electric Co., Ltd.
Telephone cords.—Phœnix Telephone and Electric Works, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe and Firebrick Co., Ltd.; J. Oakes & Co.
Charging panels.—Power Equipment Co., Ltd.
Insulated bronze wire.—Johnson & Phillips, Ltd.
Copper wire.—T. Bolton & Sons; British Insulated & Helsby Cables, Ltd.; Enfield Ediswan Cable Works, Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Wire Co. & Smiths, Ltd.).
Flameproof v.i.r. wire.—Macintosh Cable Co., Ltd.
Leclanché zinc rods.—Siemens Bros. & Co., Ltd.
Manufacture, supply, drawing-in, and jointing of cable.—Low Moor: Western Electric Co., Ltd. Paddington-Kensington-London Wall Junction: Western Electric Co., Ltd. Halifax-Bradford: British Insulated & Helsby Cables, Ltd. Warrington-Northwich: British Insulated & Helsby Cables, Ltd. Swansea-Pontardawe: Pirelli-General Cable Works, Ltd.
Telephone exchange equipment.—Middlesex Hospital, W.: Relay Automatic Telephone Co., Ltd. Stirling: Western Electric Co., Ltd.; sub-contractors for batteries: Chloride Electrical Storage Co., Ltd.; for charging set: Electrical Construction Co., Ltd. Wednesbury: Siemens Bros. & Co., Ltd.; sub-contractors for batteries: Pritchetts & Gold, and E.P.S. Co., Ltd.; for charging machine: English Electric Co., Ltd.; for ringing machines: Crompton & Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services (Houses of Parliament).—Air compressors: Hamworthy Engineering Co., Ltd.; electric wiring: T. Clarke & Co., Ltd.

Leigh (Lancs).—Electricity Committee. Accepted:—
Supply of slack at their wharves, at 15s. per ton.—J. Speakman & Sons, Ltd., and Wigan Coal and Iron Co., Ltd.

London.—FULHAM.—Electricity and Lighting Committee. House service meters, single-phase, 200-V, 50-cycles, 2½, 5, 10, and 30 A. Tenders were received from the following firms: — Measurement, Ltd.; Electrical Apparatus Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Bastian Meter Co.; Edison Swan Electrical Co., Ltd.; Chamberlain and Hookham; Aron Meter Co., Ltd.; Watshams, Ltd.; Thompson & Co.; Landis & Gyr; O. E. Malinverno; Hornby and Co.; W. F. Dennis & Co.; Elkay Electrical Manufacturing Co.; and Eck & Brook. The last eight tenders were for meters of foreign manufacture. The Committee recommends the acceptance of the lowest British tender, that of Measurement, Ltd.

HACKNEY.—Working Men's Club. The tender of Messrs. Munsey & Ryde (£189) for the installation of electric lighting has been accepted.

Penang.—Messrs Clough, Smith & Co. have received an order for a "Straker-Clough" trolley omnibus for Penang. It will be arranged to accommodate first- and third-class passengers.

Southend-on-Sea.—Town Council. Accepted:—
Providing and fixing non-conducting material in the interior of Leigh sub-station (£542).—The May Construction Co., Ltd.

Slaithwaite.—Urban Council. Accepted:—
Installing electric lighting at the Town Hall.—T. W. Broadbents, Ltd.

Southern Railway.—The Board of the South-Eastern and Chatham Construction and Power Co., Ltd., has intimated to the English Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., that their two tenders for motors and control gear respectively have been accepted. These equipments are required for the electrification of the first section of the South-Eastern and Chatham division of the Southern Railway, and will cover the conversion to electrical operation of the suburban services within a 15-mile radius of Charing Cross. The equipments consist of no fewer than 508 traction motors, each of 300 h.p., with the appropriate controlling apparatus. The two contracts are possibly the largest for multiple-unit equipments for main-line railway electrification which have ever been placed. The work, which will give employment to many thousands of people, spread over a period of nearly two years, forms part of an expenditure of £5,500,000, which was the subject of a guarantee under the Trade Facilities Act.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

WE have to remind readers that Service Department inquiries should be accompanied by a stamped addressed envelope.

The makers or suppliers of the following devices are asked for:—

DENNY-GOURLOY Miners' Safety Lamp.
Carbon filaments for electric lamps.

NOTES.

Fatality.—An inquiry was held on Monday last, at Falkirk, regarding the death of a slater who received a shock at 250 volts when working on the roof of a house; he had firmly grasped one of the wires with his hand, and the other was in contact with his neck. A formal verdict was returned by the jury.

Appointments Vacant.—Mains assistants (N.J.B. Schedule, Class H, Grade 7) for the Birmingham Electric Supply Department. (See our advertisement pages to-day.)

Edinburgh Fire Alarms.—The Corporation Plans and Works Committee has approved of a proposal to install a fire-alarm telephone system throughout the city and suburbs at an approximate cost of £1,000.

The Work of the Post Office.—On a vote of £31,873,510 in respect of the Post Office, Sir L. Worthington-Evans (Postmaster-General), according to the *Morning Post*, stated in the House of Commons on July 24th that the commercial results for the year 1922-23 were much better than was expected. The net surplus revenue over expenditure was about £5,500,000. The postal services showed a surplus of nearly £6,000,000, and the telephones one of just over £1,000,000. That £7,000,000, however, had to be reduced to £5,500,000 by a deficit of £1,500,000 on the telegraph service. The improvement was due to a reduction in expenditure of £3,500,000, against which had to be set a revenue lower by £1,000,000 than the estimate.

The net estimate of expenditure for 1923-24 was £50,750,000, which showed a reduction of about £3,000,000 on the estimate for 1922-23. Of this reduction £2,500,000 was due to a saving in salaries and wages. The reduction would have been greater had it not been for the expansion of the telephone service. They expected to spend more than last year on the development of telephone and wireless services; that was not only inevitable, but it would be reflected by increased revenue, if not this year in the near future. Heavy reductions in Post Office and telephone charges came into operation in May and July of this year, and it was expected that this year the revenue would lose thereby about £2,000,000. Telegraphs were estimated to provide a revenue of £5,250,000, but as the expenditure was estimated at £6,600,000, the deficit would be about £1,350,000. The estimated revenue from the telephones, after making the reductions in the rates already announced, was £14,000,000. This showed a surplus of £750,000.

With regard to the telephone system, during 1922-23 97,000 new subscribers and 165,000 new stations were added, representing, after allowing for cessations a net increase of 51,000 subscribers and 74,000 stations. The total number of stations on March 31st was 1,050,000. The increase during the year was equivalent to about 8 per cent., and was the highest recorded increase in any one year in this country. Efforts had been made during the year to extend the telephone system in rural areas, and the exchanges authorised provided for 4,500 new subscribers, of whom about 2,000 had already been connected. The development of the automatic telephone had been steadily pressed on, and new automatic exchanges had recently been opened at Fleetwood and Southampton, and others would shortly be opened in Dundee and Swansea. The installation of the automatic system in London had been the subject of careful study by the Post Office engineers and some of the manufacturing companies for some time past. The complexity of the problem was illustrated by the fact that facilities of intercommunication with each other without the intervention of an operator would ultimately have to be provided for 1,000,000 subscribers.

An agreement had been reached between the three leading telephone manufacturing companies by which the patents owned by them would for this purpose be pooled, and orders would be placed immediately for two large exchanges in Central London. In future nearly all the new exchanges in the London area would be of the automatic type, and it was hoped to place orders in the next three years for equipment of about 85,000 lines.

With regard to broadcasting, 52,264 experimental receiving licences had been issued, 111,905 broadcast receiving licences, and 843 transmitting licences.

The Government's policy regarding wireless communication

within the Empire was announced in March last, since when two applications from private undertakings had been received, one from the Marconi Co. for a general licence covering the whole of the British Empire as well as foreign countries, and the other from the Eastern Telegraph Co. for a licence to erect stations for a service between India and Great Britain. The Eastern Telegraph Co. had made a similar application to the Government of India, which had not yet reached a decision. Negotiations had been proceeding with the Marconi Co. as to the basis upon which the services conducted from the Government station and the company's stations should be organised. It was proposed that the agreement should include the following conditions:—

1. The services with the British Empire to be conducted through stations provided by the company and the Government respectively in agreed proportions, the company at the outset to provide two stations and the Government one, apart from the existing stations at Leafield and Carnarvon.

2. The stations to be maintained at the cost of the party providing them.

3. The revenue of the stations to be pooled and divided between the company and the Government in agreed proportions based upon the effective power of the stations contributed by each.

4. The whole of the services to be worked from the General Post Office by Government operators. A proportionate part of the cost, including overhead charges, to be charged against the company.

5. Unrouted traffic to be allocated between cables and wireless on the principle of the least delay at the transmitting point.

6. The rates charged to the public to be settled by mutual agreement; when possible the rates to be lower than the cable rates.

7. The Government to have power to admit other parties to the pooling arrangement provided it is satisfied that the are able to provide a station of substantially equal efficiency, and to retain its right to licence other parties to conduct wireless services without admitting them to the pool.

8. The Government to have the power of expropriation at specific intervals, and on terms to be agreed, probably at the end of the first ten years and subsequently at suitable periods.

A site near Rugby had been acquired for the Government station, and orders had already been placed for a part of the plant required. It might be twelve months before the station was ready. The duration of the contract was 25 years, subject to the expropriation clauses.

The Electro-Harmonic Society.—The annual general meeting of the Electro-Harmonic Society is to be held to-day at 4.30 p.m., at the Institution of Electrical Engineers. The report of the Committee states that during the season 42 new members were elected; the total membership at the close of the season as 443, showing a net reduction of 56 members. The receipts exceeded the expenses by £27. The removal to Caxton Hall has been justified by the results, and the hall will be used throughout the next season. The death of Mr. Leo Stormont is noted with regret; Madame Stormont will act jointly with Mr. Bernard Flanders, A.R.A.M., in the musical direction of the concerts. Cordial thanks are expressed to Mr. R. W. Hughman for undertaking the secretarial duties during the absence of Mr. W. E. Lane, in Australia.

The Institution of Electrical Engineers.—A special general meeting of corporate members and associates was held on the afternoon of July 19th, to receive the report and accounts of the liquidators (Sir J. Devonshire and Mr. P. F. Rowell) showing how the winding-up of the "old" Institution had been conducted, and its property disposed of, and to pass an extraordinary resolution as to the disposal of the books, accounts, and documents of the company and of the liquidators thereof. The meeting was purely formal and was called for the purpose of complying with the requirements of the Companies' Acts. All creditors have been paid, and the property of the "old" Institution has been transferred to the Institution of Electrical Engineers incorporated by Royal Charter.

Educational. — UNIVERSITY COLLEGE, SWANSEA.—In an advertisement in this issue, giving details of the curricula of the Engineering and Metallurgical Departments, the authorities announce that entrance scholarships will be offered for competition in September.

Smoke Nuisance Bill.—The text was published, on July 23rd, of a Bill introduced by the Earl of Onslow to amend the law relating to smoke nuisances. Among other things, it is sought to increase the maximum penalty from £5 to £50, and a wider interpretation of the term "smoke" is made to include soot, ash, grit, &c.

Radio Reception on Moving Vehicles.—A travelling radio telephone installation, with a sending range of nearly 100 miles, organised by the magazine *Je Sais Tout*, set out from Paris on July 18th to visit over 40 towns in every part of France, says *The Times*, which also records that an interesting demonstration of the progress which has been made in the adaptation of receiving sets with concealed aerials to private cars was given on July 14th by the Marconi Co. A party of fifty people in a fleet of cars were driven to Windsor, and while in Windsor Great Park the guests in the closed cars heard comfortably and clearly the concert from "2 L.O."

The apparatus is very neatly enclosed in the car, and beyond a small covered switch-box fixed near the seats, and the head-'phones, there is nothing noticeable. The receiving set is a complete unit, and can be transferred to the house and connected up with the ordinary aerial and earth and the accumulator. The car accumulators provide the filament current. A two-stage amplifier and loud speaker can be added to the set, if required, in which case, while the car is standing outside a house, the loud speaker can be taken inside on a long lead and used without removing the set from the car.

London and Home Counties Electricity Supply.—The Special Committee on London Electricity Supply appointed by the London County Council reports that at a meeting between its representatives and those of the London companies the former put forward the following heads of agreement, with a view to meeting the objections of the Companies to the draft scheme of the Electricity Commissioners:—

(A) A Joint Electricity Authority to be established for a Greater London Area.

(B) 1. Provided that a satisfactory sliding scale of prices and dividends can be agreed, the London Companies to be empowered to amalgamate; to have an extension of tenure to 1971; undertakings then to be transferred to the Joint Electricity Authority on the following terms:—

(*a*) Assets in use when the Joint Electricity Authority is constituted to be transferred free of cost to the Joint Electricity Authority.

(*b*) Assets subsequently provided by the Companies to be transferred on payment of capital expenditure less depreciation (to be provided by sinking fund);

2. Companies to have financial and administrative independence subject only to the control of the Joint Electricity Authority in regard to—

(*a*) Technical development (in accordance with the agreed scheme);

(*b*) Disposal of surplus energy over and above that required for the united needs of the companies concerned;

(*c*) Capital expenditure by the companies which will ultimately be repayable by the Joint Electricity Authority (*i.e.*, expenditure not entirely covered by sinking fund before 1971); and

(*d*) Maintenance of the assets to be transferred ultimately to the Joint Authority.

The companies to have a right of appeal to the Commissioners in regard to matters arising under any of the foregoing heads (2) (*a*), (*b*), (*c*) and (*d*).

(C) The London Companies to provide sinking funds—

(1) To liquidate by 1971 the value of the physical assets in use at the date when the Joint Authority is constituted, as determined on the basis of capital properly expended by the individual companies less depreciation; and

(2) To provide for the depreciation of assets representing future expenditure.

(D) In view of the large measure of autonomy to be given the London companies, their representation on the Authority should be very small.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. A. U. ALCOCK, M.I.E.E., of Melbourne, is in this country on a business visit in connection with the various concerns that he is interested in. Mr. Alcock is chairman of directors of Messrs. Herbert del Cott Pty., Ltd., and Electric Mechanisms Pty., Ltd., and technical adviser to the Australian Porcelain Co., Pty., Ltd.; he was the founder of the A. U. Alcock Electric Light & Motive Power Co., Ltd., which, together with the New Australian Electric Co., formed the nucleus of the present Melbourne Electric Supply Co., Ltd.

A correspondent states that Mr. J. W. BLAKEMORE, who for the last ten years has been traffic superintendent of the Salford Corporation Tramways, has been appointed deputy-manager, subject to the approval of the Town Council. Mr. Blakemore has been associated with the Salford tramway undertaking for 22 years.

Obituary.—MR. REGINALD LAURENCE.—We regret to record that Mr. Reginald Laurence, of Felthorpe Hall, chairman of Laurence, Scott & Co., Ltd., of Gothic Works, Norwich, for 35 years, died on July 22nd, at the age of 66 years. He sailed for Teneriffe in December last for the benefit of his health, but on his return he entered a nursing home in London and it was there he passed away. Mr. Laurence was born at Clapham Park, Surrey, and after his education at Harrow and Dublin, he spent some time on a course of study in

engineering at the works of Cockerill at Liége. When he took up his association with Laurence, Scott & Co., Ltd., in 1888—the quite early days of electricity as a motive power—his interests became largely connected with Norwich and Norfolk. He took a very active interest in Red Cross matters quite early in the War. He and Mrs. Laurence turned their home into a Red Cross Hospital; they were respectively, commandant and quarter-master; and he presented a fleet of ambulances for convoy purposes and so forth. Among other unobtrusively rendered public services was the procuring of recreation ground for the village; he was prominently connected with the management of the Norfolk and Norwich Hospital, to which, at a time of need, he anonymously presented an operating table and complete lighting installation. He is described as possessing a singularly gracious and courteous manner, as living a quiet and laborious life, and as shunning publicity. His only hobby was croquet, in which he was an expert. He is survived by Mrs. Laurence, but leaves no family.

MR. RICHARD WHICHELLO.—The death occurred on April 28th, after a short illness, of Mr. Richard Whichello, a leading member of the British community at Rio de Janeiro and an original member of the British Chamber of Commerce in Brazil. His firm was engaged in electrical and other importing and installation work.

DR. OSKAR LASCHE.—The death is announced from Berlin at the early age of 55 years, of Herr Oskar Lasche, a director of the Allgemeine Electricitats Gesellschaft, of that city. The deceased is described as a pioneer worker in field of rapid electric railway transport.

Wills.—MR. F. W. HARMER, who passed away in April, aged 87 years, was chairman and managing director of the Norwich Electricity Co., Ltd. before the undertaking was transferred to the Corporation. He left £103,301 gross and £93,395 net personalty.

NEW COMPANIES REGISTERED.

County Electrical and Wireless Stores, Ltd. (191,328).—Private company. Registered July 16th. Capital, £1,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—F. C. T. Lane, 52, Shalstone Road, East Sheen, S.W.14; R. J. Frost, 131, Topsham Road, Upper Tooting, S.W.17. Registered office: 1, Broad Street Place, E.C.2.

Lacy Induction Coil Co., Ltd. (191,294).—Private company. Registered July 13th. Capital, £26,725 in 25,500 ordinary shares of £1 each and 24,500 founders' shares of 1s. each. To acquire a licence under a patent, dated July 22nd, 1921, and numbered 189,174, granted to Howard Lacy for improvements in electro-magnets, so far as the same applies or relates to induction coils, and to carry on the business of electrical engineers, electricians, manufacturers of, and dealers in electrical induction coils, X-ray, wireless telephone and wireless telegraph apparatus, &c., and to adopt an agreement with the Lacy Patents Holding Co., Ltd. The subscribers (each with one ordinary share) are:—H. Lacy, "Haycroft," Hook, Surbiton, Surrey, engineer; J. C. Snow, "The Grange," Wimbledon, S.W.19, silk merchant; E. A. Hoghton, 52, First Avenue, Hove, Sussex, electrical consultant; W. A. Crowther, "Mount Edgerton," Huddersfield, woollen cloth manufacturer; L. Wilkinson, 83, Westbourne Terrace, W.2, merchant. The first directors are to be appointed by the subscribers. Lacy Patents Holding Co., Ltd., may, so long as they hold two-thirds of the issued founders' shares, appoint and remove two directors. Qualification, 100 shares. Registered office: 48a, Gillingham Street, Pimlico, S.W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £20,000 on various dates from April 1st to June 12th, 1923, of debentures covered by trust deed dated May 7th, 1918, securing £600,000.

Brownlie & Green, Ltd.—Satisfaction in full on June 29th, 1923, of charge dated January 14th, 1921, securing £2,460 19s. 3d.

Tubes, Ltd. (91,224).—Return dated November 30th, 1922 (filed February 15th, 1923). Capital, £150,000 in £1 shares. All shares taken up. £1 per share called up on 82,859, and 10s. per share on 49,450 shares. £107,584 paid. £42,416 considered as paid, being £1 per share on 17,691 and 10s. per share on 49,450 shares. Mortgages and charges, nil.

Mitchell's Electrical and Wireless, Ltd.—E. S. Thorn, A.C.A., of 68, Coleman Street, E.C.4, was appointed receiver on July 6th, 1923, under powers contained in debenture dated December 11th, 1923.

Douglas Southern Electric Tramways, Ltd. (45,701).—Return dated January 4th (filed March 9th), 1923. Capital, £50,000 in 30,000 preference and 20,000 ordinary shares of £1 each. 25,973 preference and 15,472 ordinary shares taken up. £18,370 paid on 12,566 preference and 5,804 ordinary shares. £23,075 considered as paid on 13,407 preference and 9,668 ordinary shares. Mortgages and charges, £1,376 13s. 6d.

Joseph Evans & Son (Wolverhampton), Ltd. (95,446).—Return dated January 12th, 1923. Capital, £125,000 in £1 shares. 113,508 shares taken up. £13,508 paid. £100,000 considered as paid. Mortgages and charges, £50,000.

C. T. Briscoe & Son, Ltd.—Mortgage dated July 10th, 1923, to secure £1,000, charged on 33 and 33a, Preston New Road, Blackburn. Holders: Trustees of the Blackburn Philanthropic Mutual Assurance Society.

Thames Electric Wireless Co., Ltd.—Particulars filed of £300 debentures authorised June 15th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Colombian Power and Transport Co., Ltd.—Particulars filed of £25,000 debentures authorised February 23rd, 1923, charged on the company's undertaking and property, present and future, the whole amount being now issued.

Johnson & Turner, Ltd.—Particulars filed of £500 debentures authorised June 14th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Electric Sign Co., Ltd. (45,610).—Return dated March 6th, 1923. Capital, £5,000 in £1 shares. 2,500 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

Electricity House, Ltd.—Mortgage debenture dated June 28th, 1923, to secure £70, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. J. Morris, 57, Lonsdale Road, Wolverhampton. D. E. Campbell, of 79, Lichfield Street, Wolverhampton, was appointed receiver on June 29th, under powers contained in debenture dated June 28th, 1923.

Premier Accumulator Co. (1921), Ltd. (178,158).—Return dated June 15th, 1923. Capital, £40,000 in £1 shares. All shares taken up. £1 per share called up on 11,249 and 15s. per share on 10,000 shares. £18,749 paid. £18,751 considered as paid on 18,751 shares. Mortgages and charges, nil.

CITY NOTES.

Eastern Extension, Australasia, and China Telegraph Co., Ltd.

The gross revenue for the year ended December, 1922, was £2,061,544, from which is deducted £755,440 for the ordinary expenses and £319,938 for maintenance of cables and special expenditure, leaving a balance of £986,166. After providing £231,267 for income tax and corporation tax payable in England, and £30,096 for interest on the mortgage debenture stock, there remains £724,803, plus £307,880 brought forward, making a total available balance of £1,032,683. £250,000 of this has been transferred to the general reserve fund, and, after paying 10 per cent., free of income tax, £382,683 is carried forward. The duplication of the Penang-Colombo section has been successfully completed, and the cable has been opened for traffic.

Fellows Magneto Co., Ltd.

Net profit for 1922, £1,025, compared with a loss for the previous year of £49,009. The directors state (says the *Financial Times*) that the improved position has been attained almost entirely on the sale of magnetos. Business in wireless apparatus did not commence until towards the end of July, 1922. Consequently, the beneficial results accruing from this branch of business are not very considerable in the accounts under review. Sales of wireless apparatus in the current year have been quite satisfactory. Stock on hand has increased mainly owing to additional business in wireless apparatus. The directors feel that the position is not on the whole unsatisfactory, and that, given normal times, a return to former prosperity may reasonably be looked for. They do not recommend payment of any dividends this year.

Venezuela Telephone & Electrical Appliances Co., Ltd.

The *Financier* states that in accordance with resolutions passed at an extraordinary general meeting held on July 13th, the directors of this company have just been offering for subscription by the shareholders 61,400 8 per cent. cumulative participating preference shares of £1 each at par. The shares will participate *pari passu* with the ordinary shares in the profits remaining after payment of a non-cumulative dividend of 8 per cent. on the ordinary shares. The issue is made for the purpose of discharging the indebtedness of the company and to some extent of providing additional working capital.

Prospectus.

United Engineering & Manufacturing Co., Ltd.—The list was opened on Tuesday and will close on or before to-morrow, in an issue at par of 10,000 ten per cent. cumulative preference shares of £1 each, and 35,000 ordinary shares of £1 each in this company. The company will acquire the assets of the Arrota Electrical & Motor Accessories Co., Ltd., of Louth, Lincolnshire, and the sole manufacturing and selling rights of the Shaw Electric Power Transmission (a report by Mr. H. Marryat on this transmission gear is given in the prospectus) and the proprietary rights in a universal lifting jack. It appears that the Arrota Co. ceased operations in December, 1922, as the directors did not feel justified in carrying the business on without further capital. The purchase price to be paid by the company is £19,547 (in cash). The present issue is estimated to provide £23,000 for working capital after deduction of the purchase consideration, preliminary expenses and underwriting commission. As the *Financial Times* remarks, the undertaking is obviously a speculative one and "depends for success mainly on the popularity of specialities, two of which have not yet been fully patented nor commercially tested."

Westinghouse Electric and Manufacturing Co.

The net income for the year ended March 31st, 1923, was $12,263,485, as shown by the company's annual report, recently issued. The dividend requirements were $6,033,428, so that over twice this amount was earned and more than $6,000,000 added to the surplus. Gross sales for the year were $125,000,000, which represents an increase of $25,000,000 over the sales of last year. The cash position of the company is a strong one, the current assets totalling over $106,000,000, and the current liabilities less than $17,000,000.

The bookings of new business steadily increased during the year and the value of unfilled orders at the close of the year was $61,914,237, as compared with $50,740,696 at the close of the previous year. A plant located at Sharon, near Pittsburgh,

Pa., was acquired during the year, and it is planned to concentrate the manufacture of transformers there. Two hundred dwelling houses, located near the company's south Philadelphia works, and formerly the property of the Emergency Fleet Corporation, were purchased and are being sold to employés.—*National Electragist.*

Stock Exchange Notices.—Dealings in the following securities for cash or for account have been specially allowed by the Stock Exchange Committee under Rule 159:—

American Telephone & Telegraph Co.—$4,057,500, capital stock in shares of $100 each.

Hollmann Manufacturing Co.—£400,000 6 per cent. first mortgage debenture stock, issued at 98½ per cent., partly paid and fully paid.

Madras Electric Supply Corporation.—38,981 ordinary shares of £1 each, fully paid, Nos. 193,820 to 232,800.

The undermentioned securities have been ordered to be quoted in the Official List:—

American Telephone and Telegraph.—$4,057,500 capital stock.

Madras Electric Supply Corporation.—38,981 ordinary shares of £1 each, fully paid, Nos. 193-820 to 232,800.

Oxford Electric Co.—£50,000 six per cent. debenture stock.

Petters, Ltd.—The accounts show a profit of £10,035, plus £10,917 brought forward, making £20,952. The position does not warrant payment of dividend at present. The preference dividend is in arrear from October 1st, 1920. According to the financial Press, the business of Vickers-Petters, in which the company has large interests, has incurred losses which have had to be written off. To meet those losses, £30,000 was transferred from reserve. An important improvement in the Petter oil engine has been developed, which may have far-reaching effects; home and foreign patents have been applied for.

Burmah Electric Tramways and Lighting Co., Ltd.—Dividend of 11 per cent., less tax, on the preference shares on account of arrears for 22 months to May 31st, 1919. The *Financial Times* states that the arrears to July 31st, 1923, remaining after payment of this dividend will be satisfied by the allotment after July 31st to preference shareholders of one new preference share of £1, credited as fully-paid, for each original £5 preference share held.

Kalgoorlie Electric Tramways Co., Ltd.—According to the *Financial Times*, the gross receipts for 1922 amounted to £30,887, against £28,632 for the previous year, and the net profits, before charging depreciation, were £8,139, against £5,817. The increase in gross receipts compared with the previous year is accounted for by the system having been entirely closed down from February 1st to 25th, 1921, during the strike of the company's employés.

W. & T. Avery, Ltd.—Dividend for the year, 15 per cent.; putting to reserve fund the premiums on ordinary shares issued during the year amounting to £17,368. Balance carried forward, £35,624.

Dublin United Tramways, Ltd.—Dividend at the rate of 6 per cent. per annum, less tax, on the preference shares, and an interim dividend at the rate of 4 per cent. per annum, less tax, on the ordinary stock.

Vickers, Ltd.—Interim divdends of 2½ per cent. on the preferred five per cent. stock and on the five per cent. preference shares, both less tax; and 2¼ per cent. on the cumulative preference shares, free of tax.

Llanelly and District Lighting and Traction Co., Ltd.—Interim dividend of 3 per cent. on the ordinary shares.

Electrolytic Zinc Co. of Australasia.—Dividend of 8 per cent. per annum for six months ended June 30th, 1923.

Mather & Platt, Ltd.—Interim dividend of 5 per cent. on the ordinary shares, free of tax.

Lanarkshire Tramways Co.—Interim dividend of 3½ per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

PRONOUNCED strength in the gilt-edged market is the outstanding feature of the Stock Exchange. All apprehension of a possible rise in the Bank Rate has been removed; at any rate for the time being. Substantial buying orders in the War Loan and other such securities indicate that money is not being used in trade. Concurrently with the firmness shown by Trustee issues, there has come a general strengthening of prices amongst industrial debentures and preferences. In such cases as those where discounts prevailed upon new issues, the weeding-out of the stag party has resulted in a recovery of values. The Tokyo Electric 6 per cent. debenture stock, offered at 94, after a dip to 2 discount, recovered to 10s. premium, and the Lima 6 per cents. at par, that is the issue price of 90, are being steadily absorbed by the investor who does not mind taking a spice of risk in order to obtain a good yield. The Home Railway market is better, and declaration of increased dividends on some of the electricity supply shares serves to keep that particular group firm.

The County of London Electric Supply Co. has declared an interim dividend on the ordinary shares of 4 per cent., compared with 3 per cent. a year ago. This led to an improvement in the price of the shares to 38s., the new ordinary advancing at the same time to 12s. 6d. premium. Upon the strength of this increase in the interim dividend, some fantastic estimates are current as to the probable final distribution, estimates which are not likely to be fulfilled, though it is, of course, only reasonable to look for a better dividend in respect of 1923 than the 10 per cent. paid for 1922. The Bournemouth and Poole interim dividend is 3½ per cent., an increase of 1 per cent., as compared with a year ago. The Kensington and Knightsbridge Electric Lighting interim dividend of 5 per cent. is the same as it was this time last year. No changes have occurred in the prices of the last two. The market as a whole is hard and further improvements are expected in the interim announcements to be made by some of the other companies. Chelseas have given way to 34s., Westminsters to 9¼, Londons to 4¾, and Newcastle-on-Tyne Ordinary to 17s. Whitehall Electric Preference are better at 19s. 9d.

The Home Railway market is better, most of the recent liquidations having been completed. Metropolitan Ordinary rose 2½ to 70. The interim dividend was due to be declared on Thursday in this week. Districts advanced on a modest amount of speculative buying. Underground issues keep steady, the income bonds being again a point higher.

Lively interest was aroused by the announcement in the House of Commons that companies other than the Marconi would be allowed to take a hand in applying for licences for the erection of power stations which should form part of the Imperial wireless chain. The Eastern Telegraph Co. was especially mentioned in this connection, and the price of the stock thereupon strengthened to 178¼. Eastern Extensions are better at 17¾, Globes at 17¾, but a few Westerns came to market, which caused the price to ease off to 17¼. Marconis went a little easier to 2 3/16, but rallied to 2¼, at which the yield on the money, assuming the 15 per cent. dividend for the year to be maintained, as is generally expected will be the case, comes to 6¾ per cent. The Anglo-American group is unchanged. Oriental Telephones eased off to 2¾.

Siemens are flat at 12s. 6d., a good deal of nervousness being felt in regard to the immediate outlook. It is generally recognised that, with the export trade in a more or less comatose condition in consequence of the chaos in foreign exchanges, companies which rely to any extent upon foreign orders are bound to suffer until such time as trade with countries outside the United Kingdom begins to recover. The recent passing of the dividends on Siemens Ordinary and Preference shares naturally created an unfavourable impression, and it may be that the ordinary will yield a little further ground, though the Stock Exchange opinion seems to be that, if Siemens go to 10s., this is about as low as they are likely to touch. Substantial contracts have been concluded by the Southern Railway for electrification of the South-Eastern and Chatham lines. The shares of the two companies mentioned, the English Electric and Metropolitan-Vickers, are unchanged on the week. English Electrics stand at 17s. 9d., the preference at 19s., and Metropolitan-Vickers at 2¼, the ordinary at 26s. 6d.

British Insulated Ordinary at 48s. 1¼d. are slightly easier, and Henleys drooped to 2¾. General Electrics are steady at their previous prices. Babcock & Wilcox at 2 7/32 are 1/32 down. Armament, coal, iron and steel shares continue to be somewhat neglected, in view of the state of trade. After being mildly distressed by the incidence of the dock strike, the market shows a slightly harder tendency, though here, again, the difficulties in the way of export business lay a restraining hand upon speculation or investment on the part of prospective buyers.

The rubber market is better, in consequence of an improvement in the price of the raw material. This has come about as a result of cautious American buying, following upon five months' steady improvement in the statistical position of raw rubber.

The bulk of the Madras Electric new ordinary shares which were offered to shareholders at 22s. have been wisely taken by those to whom the offer was made. The nominal price is still about 3d. premium, though when a market actively starts in the shares, it is more likely that the price will be in the neighbourhood of 1s. premium. Underwriters who received 7½d. per share as commission for their underwriting contracts have been freed in some cases by the taking over of their shares by people who were willing to give them, the underwriters, a profit of 6d. per share.

The Indo-European Telegraph announces that the company's through route from the United Kingdom to Teheran will be re-opened for traffic immediately. The German Government has granted to the company a preliminary concession for eighteen months. There is still a matter of detail to be settled between the two parties, but this is not expected to present any serious difficulty, and its settlement should lead to a permanent concession from the German Government up to December 31st, 1954. The price of the shares has been rising of late, and is £1 higher this week at 32¼.

Mexican Utilities continue weak. The 5 per cent. bonds of the Mexico Tramways are 3¼ lower at 76. Anglo-Argentine second preference fell back to 2¾. Brisbane Electric Tramway preference are 10s. lower at 4. British Electric Traction 6 per cent. preference has advanced to par, and at 10s., London and Suburban Traction preference show a modest improvement.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1923.	Price July 24. 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	1[illegible]	—	£6 2 6
Charing Cross Ordinary ...	5	9	14	11½	—	6 4 5
do. do. do. 4½ Pref.	5	4½	4½	4[illegible]	—	5 2 10
Chelsea	1	6	10	34/-	—1/-	5 17 8
City of London	1	14	15	2[illegible]	— [illegible]	6 9 10
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	38/-	+6d.	5 5 3
do. do. 6 % Pref. ...	1	6	6	23/9	—	5 1 1
Edmundson's Ordinary	3	Nil	7	3xd	—	7 0 0
do. 6 % Pref. ...	5	12/-	6	4[illegible]xd	—	6 8 0
Kensington Ordinary	5	10	12	9½	—	6 6 4
London Electric	3	4	10	4[illegible]	— [illegible]	6 18 0
do. do. 6 % Pref. ...	5	6	6	5[illegible]	—	5 11 7
Metropolitan	1	7	8½	31/3	+6d.	5 8 7
do. 4½ % Pref.	1	4½	4½	17/6xd	—	5 1 5
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	17/-	—6d.	2 18 10
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
do. 7 % Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill, 6 per cent. Pref....	10	6	6	9[illegible]	—	6 9 9
North Met. Elec., 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	15/-	—	Nil
do. 5 % Pref. ...	1	2½	5	18/9	—	6 8 0
St. James' and Pall Mall ...	5	12	14½	11[illegible]	—	6 2 1
South London	1	7	10	1[illegible]	—	5 10 4
South Metropolitan Pref. ...	1	7	7	1[illegible]	—	5 12 0
Westminster Ordinary	5	10	12	9½	— ½	6 6 4
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	+3d.	7 13 10

HOME RAILS.

Central London Ord. Assented	Stock	4	4	74	—	5 8 1
Metropolitan	,,	2½	3½	70	+2½	5 0 0
do. District	,,	1	3	48½	+ ½	6 3 9
Underground Electric Ordinary	10	Nil	Nil	2[illegible]	—	Nil
do. do. "A" ...	1	Nil	Nil	8/6	—	Nil
do. do. Income	Stock	4	5	98	+1	*5 2 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	— ½	5 16 6
do. Def.	,,	1½	34/6	23½	—	6 7 8
Chile Telephone	5	6	6	6½	—	4 18 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 8
Eastern Extension	10	10	10	97[illegible]xd	+ [illegible]	5 12 3
Eastern Tel. Ord....	Stock	10	10	178½xd	+1	5 12 1
Globe Tel. and T. Ord.	10	10	10	17[illegible]	+ [illegible]	5 12 0
do. do. Pref....	10	6	6	11[illegible]	—	5 5 6
Great Northern Tel.	10	24	29	27[illegible]	—	8 1 6
Indo-European	25	10	7	32½	+1	5 7 8
Marconi	1	25	15	2½	—	6 13 4
Oriental Telephone Ord. ...	1	12	12	22	— [illegible]	*4 11 5
United R. Plate Tel.	5	8	8	6[illegible]	—	*5 16 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17[illegible]	— ½	*5 13 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	8[illegible]	—	8 9 0
do. do. 2nd Pref.	5	Nil	5½	2[illegible]	— [illegible]	10 9 6
do. do. 5 % Deb.	Stock	5	5	74	—3½	6 15 2
British Electric Traction Ord.	,,	4½	5	73½xd	—	6 16 1
do. do. 6 % Pref.	,,	6	6	103xd	+1½	6 0 0
Brazil Tractions...	100	Nil	4	50½	—	7 18 6
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	86½xd	—	5 15 7
do. do. Preferred	,,	5	96/-	81½xd	—	*5 18 9
do. do. Deferred	,,	8	127/-	88½	—1	*7 5 0
do. do. Deb. ...	,,	4[illegible]	4[illegible]	81	+1	5 5 0
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	10/-	+6d.	10 0 0
London United Tram. Deb. ...	Stock	4	4	61½	—	6 10 0
Mexico Tram. 5 % Bonds ...	—	Nil	Nil	75	—3½	6 11 7
do. 6 % Bonds ...	—	Nil	Nil	58½	—1	Nil
Mexican Light Common ...	100	Nil	Nil	28½	—	Nil
do. Pref.	100	Nil	Nil	53	—	Nil
do. 1st Bonds ...	—	Nil	5	65½	—	7 12 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	15	20	2[illegible]	— [illegible]	4 10 0
British Aluminium Ord. ...	1	10	5	12/9	—	5 6 8
British Insulated Ord.	1	15	15	2[illegible]	— [illegible]	6 5 0
Callenders...	1	15	15	2½	—	6 0 0
do. 6½ Pref.	1	6½	6½	23/9xd	—	5 9 5
Crompton Ord.	1	10	5	[illegible]	—	8 17 6
Edison-Swan	1	10	Nil	4/3	—	Nil
do. do. 5 % Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	1[illegible]	—	6 16 1
English Electric	1	8	5	17/9	—	5 12 8
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	10	5	19/9	—	5 1 3
Henley	1	15	15	2[illegible]	— [illegible]	6 6 4
do. 4½ Pref.	5	4½	4½	4[illegible]	—	5 2 10
India-Rubber	1	10	—	[illegible]	—	—
Met.-Vickers Pref.	2	8	8	2½	—	6 8 0
Siemens Ord.	1	10	10	5/8	— ½	Nil
Telegraph Con.	12	20	20	25½xd	—	*4 16 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price July 25th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	6d.	[illegible]d. dec.
a Ammoniac, Sal	per ton	£60	...
a Ammonia, Muriate (large crystal)	,,	£69	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£27	20/- dec.
a Copper Sulphate	,,	£26 10s.	5/- dec.
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5d.	...
a Shellac	per cwt.	£13 10s.	5/- dec.
a Sulphur, Sublimed Flowers ...	,,	£8 10s.	10/- dec.
a ,, Roll	,,	£8	10/- dec.
a Soda, Chlorate	per lb.	3d.	...
a ,, Crystals	per ton	£5 10s.	...
a Sodium Bichromate, casks ...	per lb.	4½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£115 to £120	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£169	£5 dec.
Grade II	,, ,,	£122	£1 dec.
Grade III...	,, ,,	£70	£2 dec.
c Brass (rolled metal 2' to 12' basis)	per lb.	10d.	½d. dec.
c ,, Tubes (solid drawn) ...	,,	1/0 to 1/0½	½d. dec.
c ,, Wire, basis	,,	10½d.	½d. dec.
c Copper Tubes (solid drawn) ...	,,	1/1½d.	½d. dec.
c ,, Bars (best selected) ...	per ton	£100	£2 inc.
c ,, Sheet	,,	£100	£2 inc.
c ,, Rod	,,	£100	£2 inc.
d ,, (Electrolytic) Bars ...	,,	£73	5/- inc.
d ,, ,, Sheets ...	,,	£145 10s.	...
d ,, ,, Wire Rods ...	,,	£83	5/- inc.
d ,, ,, H.C. Wire ...	per lb.	10½d.	½d. dec.
f Ebonite Rod	,,	3/6	...
f ,, Sheet	,,	3/-	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	1/2½	½d. dec.
l Iron Pig (Cleveland Warrants) ...	per ton	9 3s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£25	...
g Lead, English Pig	,,	£26	5/- inc.
g Mercury	per bot.	£10 to £10 5s.	5/- inc.
e Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e ,, ,, medium...	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/2	...
p ,, drawn bars and rods	,,	1/3½	½d. dec.
p ,, rolled strip & sheet	,,	1/3½	...
p ,, wire	,,	1/4	...
o Platinum	per oz.	£23	...
d Silicium Bronze Wire	per lb.	1/1½	...
r Steel, Magnet, in bars	,,	10d.	...
n Tin, Block (English)	per ton	£186 to £186 5s.	[illegible] £3 5s. to [illegible] £4 inc.
n ,, Wire, Nos. 1 to 16	per lb.	3/-	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

New Ramsay Fellowships.—The Ramsay Memorial Fellowship Trustees announce the following elections to fellowships and renewals of fellowships for the session of 1923-24:—

A British Fellowship of £300 to Mr. Samuel Coffey, to carry out research at University College, London.

A British Fellowship of £300 to Mr. Alan Francis Titley.

A British Fellowship of £300 renewed to Dr. R. W. Lunt, at present working at University College, London.

A Glasgow Fellowship of £300 to Mr. Thomas S. Stevens, to carry out research work at the University of Glasgow.

A Glasgow Fellowship of £300 renewed to Mr. J. A. Mair, to continue work at the University of Glasgow.

A Norwegian Fellowship of 5,400 kr. (about £300) to Mr. Gunnar Weidemann, to work at Cambridge.

A French Fellowship of the value of £100 plus 14,000 fr. (£560 nominally) to Dr. H. Weiss, of La Sorbonne, who will work at the Royal Institution (Davy Faraday Laboratory).

A Netherlands Fellowship of £300 to Mr. J. Kalff, working at Amsterdam.

A Danish Fellowship of £300 to Mr. Kristian Hjendahl, who will continue work at the University of Liverpool.—*Daily Mail.*

Electrical Beacons to Guide Airplanes.—The *Journal of Electricity* reports that a continuous air-mail service between New York and San Francisco is shortly being commenced. The airplanes will cover the distance of 3,000 miles in 2[illegible] hours. To aid pilots at night, huge electrical beacons are being erected. These will turn at three revolutions per minute and project their beams at an angle of three degrees above the horizontal. There will be five beacons, each of 600,000,000 candle-power, at Chicago, Iowa City, Omaha, North Platte and Cheyenne. Smaller beacons, at 25-mile intervals, will mark emergency landing grounds.

THE MEASUREMENT OF INSULATION RESISTANCE.

By T. R. WARREN.

DURING the last few years we have witnessed marked developments in the transmission and utilisation of electric power for industrial and other purposes, and it is becoming increasingly evident that, in order to minimise the disturbances due to faults, we must have convenient and accurate methods of measuring the insulation resistance both of the supply mains and of the apparatus connected to them.

In this article the author endeavours to show how the Russell method of determining the insulation resistance of direct-current systems without interrupting the supply has a wider application than has been previously supposed. It has already been shown how, by making sine wave assumptions, this method can be applied to the three-phase case.*

In order to make the problem more general, the n-phase system will be considered, and the effects due to harmonics in the e.m.f. waves, to voltage drop, and to faulty apparatus will be taken into account. The proof is based, on the statical analogy which is to the effect that if particles of mass which are inversely proportional to the insulation resistances of the various portions of the network be placed in their proper positions on a diagram representing the magnitudes and phase relationships of the line voltages, then the centre of gravity of these masses will be the point of zero potential. The problem is illustrated by the n-sided voltage polygon A B C . . . . (fig. 1), the point O being

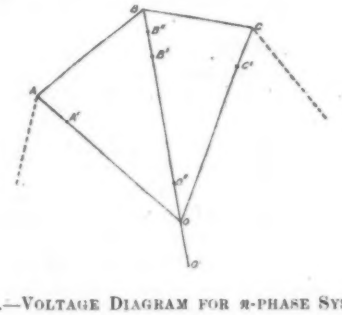


FIG. 1.—VOLTAGE DIAGRAM FOR n-PHASE SYSTEM.

the centre of gravity of all the masses forming the total insulation resistance F of the system. If f_A, f_B, f_C . . . . represent the insulation resistances of the mains only, then the masses, $1/f_A$, $1/f_B$, $1/f_C$ . . . . will be distributed, owing to voltage drop, along the lines OA, OB, OC . . . . respectively, their centres of gravity being normally at the points A′, B′, C′. . . . . The bulk of these masses will lie close to the angular points of the polygon, since, in practice, the voltage drop is not large; for clearness, however, the distances AA′, BB′ CC′ . . . . have been exaggerated in fig. 1. The effect of faulty apparatus will be to add masses, in addition to those previously mentioned, to various parts of the polygon.

If we consider the masses forming $1/f_B$ (say) to be removed, it is clear that the point O will move away from B in the direction of the line BO, and will take up a new position O′. Taking moments about O, we have :—

$$B'O/f_B = OO'\,(1/F - 1/f_B) \text{ or } B'O'/f_B = OO'/F. \quad (1)$$

If an artificial leak of value x ohms, for instance, be now made at B, the point B′ will move towards B along the line B′B and take up a new position B″ such that—

$$B'B''/f_B = BB''/x. \quad \ldots \quad \ldots \quad (2)$$

Also the point O will move towards B along the line OB, and will take up a new position O″. Equation (1) now becomes—

$$B''O'\,(1/f_B + 1/x) = O''O'\,(1/F + 1/x). \quad (3)$$

Subtracting (1) from (3)—

$$B'B''/f_B + B''O'/x = O''O/F + O''O'/x.$$

Substituting for $B'B''/f_B$ the value BB''/x from (2), we get—

$$O''O/F = BO''/x. \quad \ldots \quad \ldots \quad (4)$$

If $BO = V_B$, the original potential of the main, and if $BO'' = V_B'$, the new potential of the main when earthed through the resistance x, then, since $O''O = V_B - V_B'$, equation (4) becomes

$$F = (V_B - V_B')\,x/V_B',$$

or finally, $$F = (V_B - V_B')/C, \quad \ldots \quad \ldots \quad (5)$$

where $C = V_B'/x$, the current through the resistance which may be read directly on an ammeter.

It will be seen that (5) corresponds with the well-known formula used for determining the value of F for two-wire and three-wire d.c. systems which are, of course, particular cases of the general theorem outlined above, since the voltage polygon now reduces to a straight line. The proof of the method for the n-wire d.c. system also follows readily from a direct application of Kirchhoff's law.

An investigation of the effects produced by irregularities in the shape of the e.m.f. waves seems at first to present considerable difficulty, since the alternating quantities involved cannot be represented graphically. The problem becomes quite simple, however, when each harmonic is first considered separately. If the fundamental only were present, we should have, from (5),

$$V_1/C_1 = F + x$$

where V_1 and C_1 are the fundamental components of V_B and C respectively. Similarly, if the third harmonic only existed we should have $V_3/C_3 = F + x$, and for the fifth harmonic $V_5/C_5 = F + x$.

From this it is seen that

$$V_1/C_1 = V_3/C_3 = V_5/C_5 = \ldots = F + x.$$

If the ammeter and voltmeter both read true r.m.s. values—the moving-iron or hot-wire types would be suitable—then

$$V_B/C = \sqrt{(V_1^2 + V_3^2 + V_5^2 + \ldots)}/\sqrt{(C_1^2 + C_3^2 + C_5^2 + \ldots)}.$$

By substituting for $C_1, C_3, C_5 \ldots$, in terms of $V_1, V_3, V_5 \ldots$ respectively, or *vice versa*, the above formula becomes—

$$V_B/C = F + x.$$

Since this formula is the same as the one obtained above, we are led to conclude that the previous theory is entirely independent of wave form. This somewhat unexpected result is of considerable help in generalising the method, thus adapting it to the various types of systems at present in use.

It is interesting to notice that, provided the load remains steady during the test, the voltage drop does not in any way affect the accuracy of the method. This is contrary to present belief since, in testing d.c. mains having a voltage drop of 5 per cent. on a heavy load, an inaccuracy not exceeding 5 per cent. is thought to exist.

In practice it is found more convenient to carry out the test at the generating station rather than at some point along the feeders, but the effect of adopting the latter procedure will merely be to move the point B along the line BO nearer to O, the proof of the method thus being not affected in any way.

As a final observation on the above theory, it will be noticed that no assumptions are made regarding the relative magnitudes of the line voltages. The result obtained is therefore applicable to all the types of alternating-current systems used in practice.

Some interesting facts regarding the power lost due to leakage currents may now be studied. It is one of the well-known theorems in statics † that the moment of inertia of a number of masses about a point exceeds that about their centre of gravity by an amount equal to the product of the total mass and the square of the distance of the point from the centre of gravity. From this the power lost by a system earthed through a resistance x may be written as:—

* See T. R. Warren, "The Insulation Resistance of Three-phase Networks," *Faraday House Journal*, Vol. X, p. 25, 1923.

† See Thomson and Tait, "Elements of Natural Philosophy." Sec. 196.

$$P = \Sigma V^2/f + (V_B - V_B')^2/F + V_B'^2/x ;$$

but, $$(V_B - V_B')/F = C ;$$

$$\therefore P = \Sigma V^2/f + V_B C. \quad \ldots \quad \ldots \quad (6)$$

The power lost in the resistance may be written as

$$P' = V_B^2 x/(F + x)^2.$$

By differentiating this expression with respect to x and equating the result to zero, we find that P' reaches its maximum value when $x = F$ and we now have

$$P'_{max} = V_B^2/4F = \tfrac{1}{2} V_B C,$$

and consequently this particular value of P' represents one-half of the total extra power, $V_B C$, found from (6), which is lost due to earthing.

Since the advantages of three-phase transmission have made its adoption almost universal, it will be useful to consider this case in greater detail, dealing first with the three-wire system. Our problem is to find expressions giving the insulation resistance of each main separately, since we can then calculate the values of the leakage currents. In addition, it is useful to know on which phase a fault is developing. It must be remembered, however, that where there is any faulty apparatus forming a part of the system, the values of the resistances obtained will be lower than the actual resistances of the mains themselves; in the case of a star-connected load, a fault in one of the arms will decrease the apparent value of f obtained for the corresponding main, while, in the case of a mesh-connected load, a fault will affect two mains though not necessarily both to the same extent.

Since, for the practical case, the line voltages may be assumed equal, the voltage polygon now reduces to the equilateral triangle ABC (fig. 2) in which OA, OB, and OC

FIG. 2.—VOLTAGE DIAGRAM FOR THE PRACTICAL THREE-PHASE CASE.

represent the potentials V_1, V_2, and V_3 of the mains respectively when the system is unearthed. If V_3 be greater than V_1, the first step is to earth the main having the smaller potential until the new potentials V_1' and V_2' are equal. If x be the value of the resistance required, then it is plain that

$$1/f_1 = 1/f_3 + 1/x. \quad \ldots \quad \ldots \quad (7)$$

If O′ be the new position of O, and if AO′ be produced to meet BC in D, then AD bisects BC at right angles and, taking moments about O′, we get

$$AO'/f = O'D\,(1/f_1 + 1/f_3 + 1/x)$$

but $$O'D = \tfrac{1}{2}\sqrt{3}\,V - V_2',$$ V being the line voltage.

Hence $$V_2'/f_2 = (\tfrac{1}{2}\sqrt{3}\,V - V_2')\,(1/F - 1/f_2 + 1/x)$$

where $$1/F = 1/f_1 + 1/f_2 + 1/f_3,$$

and therefore $$f_2 = \sqrt{3}\,V F x/(\sqrt{3}\,V - 2V_2')\,(F + x). \quad (8)$$

The values of f_1 and f_3 are now easily found, since :—

$$1/f_1 + 1/f_2 = 1/F - 1/f_2 = 2V_2'(F + x)/\sqrt{3}\,V F x - 1/x$$

and $$1/f_1 - 1/f_3 = 1/x \quad \text{from (7)}$$

By addition, $$f_1 = \sqrt{3}\,V F x/V_2'(F + x) \quad \ldots (9)$$

By subtraction, $$f_3 = \sqrt{3}\,V F x/V_2'(F + x) - \sqrt{3}\,V F. \quad (10)$$

In cases where x is so large that it need not be considered, we have

$$f_2 = \sqrt{3}\,V F/(\sqrt{3}\,V - 2V_2')$$

and $$f_1 = f_3 = \sqrt{3}\,V F/V_2'.$$

As an example, suppose $V = 2{,}000$ and $V_2' = 1{,}300$ volts. Let us also suppose that $F = 500$ and $x = 1{,}500$ ohms. We find by (9), (8) and (10) that

$$f_1 = \sqrt{3} \times 2{,}000 \times 500 \times 1{,}500/1{,}300\,(500 + 1{,}500) = 1{,}000 \text{ ohms.}$$

$$f_2 = \sqrt{3} \times 2{,}000 \times 500 \times 1{,}500/(\sqrt{3} \times 2{,}000 - 2{,}600)\,(500 \times 1{,}500) = 1{,}500 \text{ ohms.}$$

and $$f_3 = \sqrt{3} \times 2{,}000 \times 500 \times 1{,}500/1{,}300\,(500 + 1{,}500) - \sqrt{3} \times 2{,}000 \times 500 = 3{,}000 \text{ ohms.}$$

With the system dead earthed at the star point, the values of the leakage currents will be

$$C_1 = 2{,}000/\sqrt{3} \times 1{,}000 = 1{\cdot}15 \text{ amps.}$$

$$C_2 = 2{,}000/\sqrt{3} \times 1{,}500 = 0{\cdot}77 \text{ amp.}$$

and $$C_3 = 2{,}000/\sqrt{3} \times 3{,}000 = 0{\cdot}38 \text{ amp.}$$

The power lost due to leakage currents in this case will be given as

$$P = 2{,}000^2/3 \times 500 = 2{\cdot}67 \text{ kW.}$$

In the four-wire three-phase system, we have an extra unknown quantity to consider *viz.*, f_4, the insulation resistance of the fourth wire. This precludes any possibility of determining the values of f_1, f_2, f_3 and f_4, but we can always locate the main on which a fault is developing. With this system, the apparent values of f_1, f_2 and f_3 as obtained from (9), (8) and (10) will be lower than the true values by the same fractional amount in each case, since the mass $1/f_4$ can be considered as being divided into three portions and placed at the points A, B and C, each portion being proportional to the mass already there. In this way, a decrease in any one of the quantities f_1, f_2 or f indicates that a fault is developing on that particular main, while, if the same fractional decrease occurs for all three values, there is a strong probability that a fault is developing on the middle main.

ON THE E.C.A. TRADING POLICY.

By DONALD SMEATON MUNRO, M.I.E.E.

[This article is written from the individual point of view of an electrical contractor, and not from that of an official of any Association.]

ALL electrical contractors are interested in the Report of the Special Committee recently published. This Committee essayed the delicate and difficult task of formulating a trading policy, to be followed by the N.E.C.T.A., Ltd., in order to realise the ideals of the Electrical Contractors' Association.

Both in what it says and in what it refrains from saying, the report is worthy of high praise. During six days the Committee created the new electrical world and behold it was very good. Yet, in the new policy, as in the rest of the universe, the ideal is not so much in full flower as it is latent in the evolutionary plan. "Man never is, but always to be, blest."

As to the cautious nature of the policy advocated, it may be added further that it is not the first time in history that a people, weak, hopeless, disorganised, hampered by crowds of camp followers, have had to be trained by forty years in the wilderness, until their hardier sons or successors were ready and able to make victory sure.

After ascertaining "that manufacturers and wholesalers would welcome the policy outlined," the Committee "do not expect that its recommendations can be carried into effect immediately, nor, as regards some of them, for a long time perhaps." Therefore it recommends interim politic agreements with the more formidable of these traders who have so effectively trespassed upon and settled down within the domain of the contractors. In emphasising this aspect of the report, one does not necessarily condemn it. It may be the only way. "Beggars cannot be choosers."

For one thing the reader will be grateful—this article does not enlarge once again upon the many grievances of the contracting trade, a subject made yet more picturesque by the advent of wireless, so that the term electrical trader now includes everybody, from midwives

to undertakers, and from barbers to general warehousemen, all enthusiastically spoon-fed by certain manufacturers, wholesalers and agents. But one or two general remarks arising out of the recommendations of the Committee may not be out of place.

The foundation stone of the recommendations is that the Contractors' Association, having secured such buying concessions as are available to it shall use these concessions to extend its membership. To this end a new section of electrical retailers, not necessarily eligible for full membership, shall be formed to participate in *retailers'* trading advantages. Presumably this need not include trading advantages secured for electrical contractors alone.

There were some who had dreams of an Association exclusive of all but the very best class of contractor—each member highly competent and trustworthy. But this generation does not favour class distinction: to be exclusive is to be powerless. Hence the only feasible policy is to be democratic and welcome all fairly decent recruits. By including every electrical trader we add force to our negotiations. Yet we do not forget that an advantage in which all share may be less of an advantage. It, at least, cannot be accused of any degree of monopoly.

Perhaps the new National Registration Authority for Electrical Installation Contractors may conserve something of the element of quality. But this will be attained, neither by the Association nor by the Registration Authority, unless and until there be evolved a system of grading uninfluenced by the size of the orders to be placed by individual members. That is to say, neither manufacturers, wholesalers nor electricity suppliers, as such, should have any say in the matter of grading, though the system to be evolved must warrant their confidence and respect.

We must not lose sight of the main purpose of the recommendations, which is to enable the extended E.C.A. to proceed with its business unhampered by the frantic struggles of invading hosts. To accomplish this the E.C.A. must forgo for a time the realisation of some of its ideals and temporarily yield much territory which it has failed to occupy effectively and exclusively. The new policy is based upon accomplished facts which we are perhaps powerless to influence otherwise.

It is from this point of view that contractors reluctantly agree with the recommendations as a whole. Half a loaf is better than no bread.

But in entering upon this new policy we would not do so as a defeated force. The Contractors' Association is yet strong, and will be stronger, and in this connection the recommendations deserve praise. The general aims of the recommendations are excellent and permit of actual progress. They leave room for developments. A few of these may be indicated. The recommendations do not forbid:—

1. Any system of classification which members of the Association may hereafter see fit to approve as an authoritative guide to the general public, architects, and others. If the new registration schemes, controlled by varying interests, prove insufficiently definite in standard, consulting engineers as a class are not likely to be sorry.

2. The establishment by all, or by a section of the contractors of a wholesale distributing company, or even of an electrical accessories manufacturing company.

3. A united Electrical Show Rooms, Ltd.

The need or urgency of any of these depends upon arrangements made with manufacturers or wholesalers from time to time.

It may not be necessary for the Association to go out of its way to adopt the final sentence of Recommendation No. 7. A contractor placing orders for delivery in considerable parcels lessens delivery and allied costs, and is entitled to that extent to a special discount. But a cumulative discount varying in agreed steps with final annual quantities purchased has been found workable, and useful to all parties. While prompting the contractor to energetic salesmanship and to place a substantial closing order, it does not relieve the wholesaler unduly from the common risks of supply and demand. With large stock orders or guaranteed quantities, the contractor is tempted to speculate, and he will often be given the old baby to hold when inventive or manufacturing progress leads to the introduction of improved or more saleable patterns by the same or other wholesalers. The cumulative discount favours the beginner, and is an advantage which may be secured by the Association for the smaller firms of the right stamp and be an inducement for them to join.

The principle of bigger discounts for large orders for immediate delivery or otherwise requires no pushing by the Association. Its effect, however, is to secure the position of the larger buyers and keep them able to be always the larger buyers. These firms support the principle referred to, or shall we rather call it the practice, and some in supporting it may threaten to make private agreements other than through the Association. But if the increase of discount with quantity be too substantial, it not only becomes unfair, but it is not a safe policy. It first lessens, and may eventually supersede, a trade discount. Embodied in an agreement it may be used eventually to foster big retail warehousemen concerns, or even to establish, beyond the risk of competition by any existing contractor, new and strongly financed retailing or contracting concerns whose capital, perchance, may be held by the wealthier manufacturing combines.

It might have been an advantage had the Committee, in Recommendation No. 13, attempted some provisional definition of the term "trade user." This has long been a sore point, and is a vital point for contractors. The latter, after much nursing, secure a new user. It may be a big drapery warehouse or other business establishment, or it may be a great country house, or an institution, a group of schools, or a factory with motors. In former days the contractor remained interested in the efficiency of the plant and the progress of the lighting, and acted as guide, philosopher and friend to each user, and to his handy-man whom he taught to do trifling electrical repairs. The contractor sold to such users, lamps, additional plant, repair and renewal of storage batteries, and stores generally. If the contractor made little from his original contract, he at least added to his *clientèle*. His visits to the locality secured new users. But now many agents, wholesalers and even some manufacturers, spending much time and travelling money to get what was coming anyhow, discover in the handy-man, who may or may not be an electrician, a full-fledged "electrical department." So they feel free to offer the user the best or nearly best or better than the best trade terms, and the contractor is helpless. To this one thing more than anything else, the weak financial position of the contracting trade is due. To whom is the contractor to sell those substantial quantities of stock which are a condition of decent discounts sufficient to cover the onerous outlays of his business as a pioneer of the trade? The manufacturers lose his personal influence, his skilled and otherwise unpaid advocacy; they lose his former orders, and finally may here and there lose on bad debts all that they had gained by the rash over-eagerness of their young men.

The only reasonable "exceptions" under this Clause 13 are large exporters and railway, canal, tramway and dock companies or authorities, and authorised electricity undertakers. Even with these the small and doubtful fringe should be worked through "the trade."

The scope relative to retail trade is too widely indicated in Clause 12. Under it any agent or friend of an agent, or friend or employé of a "user," could be a transient retailer to secure discounts for any one transaction.

In conclusion, as our clergymen friends say, the Committee has done good useful work. Perhaps the new advance may be made yet more effective if only a good definition of trade user can be agreed upon. One is apt to find all plain sailing until real financial interests are touched.

A LIGHTING SERVICE DEPARTMENT.

A New View-Point and a New Campaign.

"Electric lighting," it has been argued, "is established; it is the best kind of light obtainable and, as such, needs no recommendation; further propaganda is, therefore, superfluous. But is not the very fact that a thing was done in a certain way last year the best possible proof that it should be, and can be, done differently this year?"

The electric lamp has ever been the fore-runner of the electrical idea; in practically every case it has opened the door for electric service.

The lighting branch of the electrical industry is, however, one of the very few commercial institutions which do not have an opportunity of showing their goods.

Hitherto, the object of sales propaganda has been to sell fittings, reflectors, lamps, wire, and electricity. There has been very little attempt to sell the finished product—light. The industry requires to adopt new methods of selling that portion of the output of our electricity generating stations which can be used for lighting purposes. The lighting load can be considerably increased, but not by continuing to sell lamps and fittings when we should really be selling "light" and seeing that the public, whose servants we are, obtains definite results. It is wrong for the industry to sell electricity, but not service, and to allow its product to be used in anything but an efficient and correct way. We must become merchants of light—the finished product— as distinct from the means of producing it.

It is essential that better lighting should be used; that the industry and public should understand the principles of good lighting, and recognise standards of intensity which are adequate and suitable for various purposes. Much good work has already been done in this direction, but past efforts have probably been of too technical a nature, and it is believed to be possible to interest the public in the subject in a more practical and simple manner—namely, by visual demonstration.

Such are the convictions of the British Thomson-Houston Co., Ltd., which has established its Lighting Service Department in new premises at 15, Savoy Street, W.C. 2, with the object of putting its ideas into practice. The department is not a commercial one—it has nothing to sell—but it hopes, in full co-operation with the industry as a whole, to do its part in helping to improve the application of light in this country. It has been organised for the express purpose of arranging demonstrations and lectures dealing with lighting fundamentals; assisting in the preparation of lighting lay-outs; studying the economics of light production; technically and practically investigating various lighting subjects; and issuing, as results are obtained, technical data on lighting subjects of interest to all engaged in the industry. It will, in fact, present an old subject from a new point of view.

That Mr. W. E. Bush and his assistants have lost no time in commencing their programme was evident last week when we were privileged to attend an advance demonstration at the new headquarters. The demonstration was convincing and was carried out in a more complete manner than has been attempted before.

Fig. 1.—Device to Illustrate the Value of Shadows.

Fig. 3.—Device to Show Effect of Light on Apparent Speed of Rotation.

Fig. 2.—Industrial Lighting Demonstration Room.

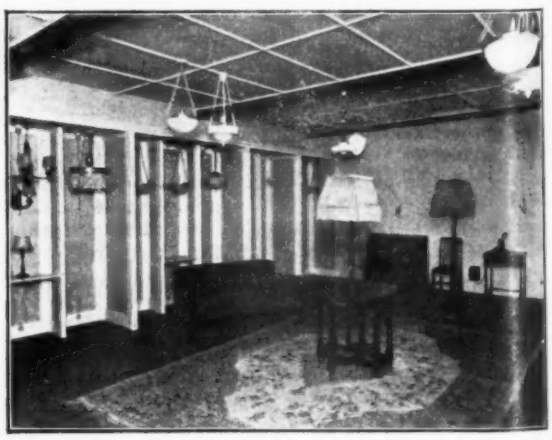


Fig. 4.—Domestic Lighting Demonstration Room.

After outlining the rapid progress which has been made in recent years in the increased efficiency of lamps, reflectors, and other illumination equipment, Mr. Bush exhibited a number of charts giving the results of investigations carried out by physicists, &c., indicating that vision in all its aspects is considerably assisted by high intensity lighting.

An interesting experiment to demonstrate these facts was made by means of the apparatus shown in fig. 3. It consists of a box in which a cylinder is revolved at constant speed by a clockwork motor, and letters are printed upon the cylinder so that they can be followed with the eye as the cylinder rotates. Lamps of various candle-powers were switched on at intervals which produced the effect that the speed of the cylinder apparently decreased as the illumination was increased. This proved that the eye can see much more quickly under high intensities, due to the fact that it can more easily appreciate movement. Results of tests carried out at a number of different industrial installations were given to show that production was increased between 10 and 25 per cent. where modern high intensity lighting had superseded lighting of the average standard. It was also shown that a large number of accidents continued to occur annually through insufficient lighting in stores and workshops.

We then witnessed a series of interesting demonstrations, commencing with an installation of antiquated cord pendants with obsolete shades and assorted lamps, giving a gloomy and depressing effect. Following this, the various steps that are necessary to build up a modern lighting system were shown, culminating with an installation of the latest R.L.M. dome reflectors and bowl enamelled lamps. The combined unit gave perfectly even illumination with an absence of glare and harsh shadows.

In order that the audience should appreciate the quantitative value of the illumination, each member was provided with a foot-candle meter, a handy little instrument with which light, in foot-candles, can be measured quite as easily as temperature is with a thermometer.

Apart from the industrial demonstrations, general methods of improving domestic and commercial lighting were also indicated. Later, other phases of illumination, such as street and sign lighting, will be dealt with.

It should be emphasised that although certain equipment has been, and will be, employed during demonstrations, the latter are not being carried out for the purpose of selling particular appliances, but merely with a view to showing, in a general way, the advantages of better lighting and the general means whereby such results can be attained.

It should be understood that the Lighting Service Department of the B.T.H. Co., Ltd., has not been merely set up as a temporary inspiration to the trade, or as an organisation for demonstrating effects. It is a permanent institution which will be constantly engaged in the investigation of lighting in all its aspects and applications. The general public will receive the benefit of the investigations carried out from time to time. The information will be conveyed through the medium of handbooks distributed among the sections of the industries concerned with the specific subject dealt with.

The first of these books has already been published; it is known as "Factory Lighting Designs," and deals with designs of electric lighting for factories and workshops. From this book, given the quantity of illumination required for any industrial purpose, and the size and height of the shop, a design can be obtained to meet all requirements. Each design is illustrated to show the spacing of the units, the candle-power of the lamps used in the units, and the resultant quantity of the available foot-candles on the work in tabular form. This booklet entirely eliminates all tedious calculations, and it can be understood quite as easily by the consumer as by the electrical contractor. A table at the end of the booklet gives the necessary amount of illumination necessary for almost any industry.

Of course, the department will prove of little value unless the trade generally co-operates in the work which it is trying to carry out.

The general standard of lighting is low, and there is enormous scope for the extension of the use of electric light. In London, with a population of 4½ millions, there are only some 214,000 electrical consumers, compared with 1,637,000 gas consumers, and the same holds in greater or less degree throughout the kingdom. What a field to work in!

If the industry can unitedly secure the results above indicated, it will be doing great public service.

PLANT BREAKDOWNS.

For the first time since 1910 the British Engine, Boiler and Electrical Insurance Co., Ltd., has issued a "technical report," giving details of accidents to electrical and other machinery, boiler plant, &c., with which the company has been concerned.

In view of the importance of turbo-generator development in recent years, this class of plant has been given the place of honour at the beginning of the report. This section contains particulars of 19 breakdowns, of which seven were due to turbine failures, and the remainder to troubles in the generators.

Three of the turbine cases were due to cracks or flaws in the first wheel; in one case the fault was discovered before a breakdown occurred, but in the other two instances the first wheels were fractured and caused considerable damage. Case No. 4 is that of a 3,000-kW, 3,000 r.p.m. turbo-generator. The vacuum failed owing to a stoppage in a circulating water suction pipe and the machine was changed over to atmosphere. This caused a rise in temperature at the exhaust end from 90 deg. to 350 deg. F., and the thin diaphragm nozzles on the last stage heated up at a disproportionate rate, causing distortion and contact with the revolving blades. This case points to the necessity of removing the load immediately upon the failure of the vacuum. The fifth breakdown was due to the breaking of the manganese-bronze paddle wheel for the l.p. water seal, fragments of this coming into contact with the revolving parts. The makers have since abandoned the use of manganese-bronze castings for this purpose. The last two cases were due to the failure of bearings, one probably on account of neglect to inspect these and the other apparently due to the passing of foreign matter through the oil filter.

The first of the generator breakdowns concerns an 8,000-kVA, two-phase, 7,500-V alternator. A short-circuit (due to a rat) occurred while the machine was working at 30 per cent. of its rated capacity. The feeder circuit-breaker concerned immediately isolated the fault and the main breaker controlling the set did not, therefore, come into action. The alternator caught fire, apparently owing to a surge in the line caused by the operation of the feeder circuit-breaker, the resultant excessive voltage breaking down the insulation. The fire originated through arcing between adjacent turns of one of the phases, and it is possible that if a protective device, capable of at once opening the exciter field, had been fitted, the damage might have been localised and the arcing stopped in time to save the machine. As it was the stator was completely burned out, although the rotor was only slightly affected. The breakdown of two 15,000-kW generators was found to be due to the vibration of the bolts which ran through the stator stampings and the end plates. The frequency of vibration of the bolts, which was dependent upon their length and diameter, and on the stress due to the screwing up of their nuts, had corresponded with the frequency of the machine. Sympathetic vibration due to resonance had damaged the insulation and the eddy currents generated in the bolts had set up arcing. As a result of experiments it was found that there would be no difficulty in designing similar machines with bolts having, when insulated and supported under running conditions, either a higher or lower frequency than that of the machine. In the case of the particular machines referred to the trouble was overcome by providing heavier end plates and dispensing with core bolts altogether. The burning-out of a 5,000-kW, 1,800-r.p.m., 6,600-V alternator was attributed to dirt. Some time before the failure the wet-air filter had been taken out, as it was of bad design, and had allowed a large quantity of water to pass into the machine. The machine was at this time thoroughly cleaned, and the insulation resistance found to be 5 megohms. After this, however, owing to the machine running without a filter, the insulation resistance commenced to drop gradually, though the machine was cleaned out every month. Dirt and moisture, which lowered the insulation

resistance, were also responsible for the breakdown of a 6,000-kW, 6,600-V, three-phase alternator. The air to the machine had been supplied through a rotary pattern, wet-air filter, which had been working unsatisfactorily.

On shutting down a 12,500-kW turbo-generator, running at 3,000 r.p.m., it was found that an "earth" had developed in the rotor circuit. This was found to be due to the mechanical collapse of the end turns of the windings at both ends; the turns had slipped one over the other and the coils had collapsed like a pack of cards. The failure was due to some of the outside coils having been forced out of a radial position where their supporting wedges were fitted. When the machine was put to work the pressure due to centrifugal force had thrust the turns further out of position and this movement, being cumulative, had ended in the final collapse of the turns. To prevent future trouble additional hardwood blocks were inserted between the coils leaving each slot.

In case No. 14, an 8,000-kW, 1,500-h.p.m., three-phase turbo-alternator, each of the stator slots contained four bars, separated by micanite and insulated over-all with micanite wrappings. The bars were secured in their slots by red fibre wedges. When a shower of sparks was seen to be rising from the air outlet of the alternator the set was shut down and it was found that one of the bars in the stator winding was earthed at a position in the centre of the slot and had burned a hole in, and was fused to, the core plates. The insulation was in a brittle condition and had crumbled away, the condition being worse at the centre of the core than at the ends. The powdered residue from the insulation was analysed, and it was seen that the material had been formed by mechanical abrasion, from which it was evident that there had been movement of the bars in the slots and there must have been a certain amount of slackness in the slots when the windings were inserted.

Another case, in which the stator of a 5,000-kW alternator stator developed an earth, was due to an insecurely fixed end plate, which allowed movement of the stator core stampings. These had cut into several of the stator coils.

An accident which caused considerable damage to a 1,000-kW, 3,000-r.p.m. generator, was due to the bursting of one of the cylindrical manganese-aluminium-brass end-rings, 20¼ in. external diameter, 19 in. internal diameter, and 9 in. wide. The centrifugal stress, at the speed at which the machine was running, amounted to only about 4 tons per sq. in., whereas pieces of the ring, when tested, yielded at 19/29 tons. The results indicated want of homogeneity in the material.

Damage was caused to the rotor of a 15,000-kW, three-phase alternator by careless handling on the part of the users, the main switch of the alternator having been closed while the set was at rest. Arcing was set up between the nickel-chromium end rings and the slot wedges, which were all badly burned.

Two examples are reported of failures which have led to the exciter becoming either demagnetised or reversed in polarity. A reversal of polarity during operation leads to a high voltage across the rotor and an excessive current in the exciter field. Troubles of this nature can be prevented by the use of compounding turns in the exciter field winding.

The next section deals with steam engines and pumps, and it is stated in the opening paragraph that, "generally speaking, steam engines have long since passed the experimental stage; there is, therefore, little in the way of novelty in the various kinds of failure which occurred."

In connection with one accident, in which a cotter securing a bucket-rod to the crosshead of a horizontal cross-compound condensing engine worked loose and sheared the bottom of the socket in which it was working, electric welding was employed to build up a new cotter bed. The repair was very satisfactory and quickly effected.

A number of gas and oil engine failures are recorded, but it is noted that the fracturing of crankshafts is of less frequent occurrence than in the past, due to more generous proportions and an improved method devised by the company for testing the alignment of shafts in their bearings.

The section of the report devoted to "Other Electrical Machinery" shows that the largest percentage of failures (38.3) occurred in rotors and armatures of electrical machines. The first example given is that of a 2,000-kW motor generator set, consisting of a 2,900-b.h.p., slip-ring, induction motor, driving two d.c. generators. The end connections of the motor were clamped to the rotor spider at intervals of 2 ft. One of these came apart owing to a bad joint in a connecting thimble. The connection was bent outwards by centrifugal force and pulled with it the end of one of the rotor bars, to which it was connected at a position half-way between the clamps. The end of this bar, as it revolved, fouled the whole of the end turns of one phase of the stator, causing heavy short-circuit currents in the stator windings. The rotor was only slightly damaged, but a large portion of the stator had to be rewound. The d.c. generators escaped damage.

(To be continued.)

BRITISH PROSPECTS IN SPAIN.

In our issue of June 22nd (p. 962) we made brief reference to the report of the Commercial Secretary to H.M. Embassy at Madrid (Capt. Charles), recently issued by the Department of Overseas Trade* The following article is based upon Capt. Charles's remarks, which cover the position up to the end of 1922.

At the close of that year, says the report, British trade had hardly had time to reap the benefits of the Anglo-Spanish commercial treaty, consequently last year showed little improvement over 1921. Foreign trade generally was not good, the three chief causes of the dullness being the depression in Spain's mining and shipping industries, the war in Morocco, and tariff uncertainties. It would appear, however, that Great Britain had a fair share of such business as was available.

France is doing well in the motor-vehicle trade, Belgium in iron and steel, but the Commercial Secretary states that Germany has lost a large volume of her custom. The activity of her agents is, however, still noteworthy, and there is said to be no falling off in the facilities for credit she is always willing to grant, nor in her intense propaganda. It appears that Spain's super-tariff has not been sufficient to provide the Spanish manufacturer with the protection he expected. Costs of production remain so high that they, to a great extent, negative the protection, and the low Continental exchanges have done the rest.

New Assessment Basis.

Here probably lies the explanation of the change in the basis of assessment of the Spanish tariffs, news of which has reached this country since Capt. Charles's report was issued by the Department of Overseas Trade. The *ad valorem* duties are to be replaced, as from July 1st, by specific duties on weight. This new arrangement should place British exporters in a better position *vis-à-vis* their foreign competitors, whose quotations have been lower, owing to depreciation of their currencies in relation to sterling and the peseta.

Comparable statistics of Spain's trade are difficult to obtain, but Capt. Charles has compiled certain details, from which it is seen that last year increased business was done in tin plate from the United Kingdom, steel billets from Belgium, hand tools from Germany and the United Kingdom, and cutlery from Germany and France. With regard to machinery, steam and electric locomotives were imported in increased quantities from Germany and Belgium, whilst there was a decrease in steam and internal-combustion engines, steam boilers, machine tools, and textile machinery. Electrical machinery came in to a smaller extent from Germany, the United States, Great Britain, Switzerland, and France. There were also fewer electric lamps imported.

Industrial Progress.

An interesting section of the report refers to manufacturing progress. Next after textiles, the most notable development has been in the construction of locomotives. Capt. Charles mentions the contract for 15 locomotives obtained by the Babcock & Wilcox works at Bilbao. A further contract for the supply of two electric locomotives was allotted to the Swiss firm of Brown, Boveri. It is added that an important reduction in duties on locomotives was obtained under the Anglo-Spanish commercial treaty, and, with falling costs of manufacture, it is to be hoped that British firms will benefit, although it appears improbable that many contracts for material other than locomotives will be placed abroad.

Electric Traction.

Attention is called in the report to the urgent need for tramways in many parts of Spain. It is intended to extend the Granada-Durcal line to Motril and to build a further line to Monachil. The Vigo Co. contemplates extensions amounting to about 35 km. of line and costing about £270,000.

Regarding the much discussed Madrid-Valencia plan, Capt. Charles says that the Sociedad Española de Industrias y Tracción Eléctrica is endeavouring to launch a vast scheme, which includes this project, and according to report, it has obtained the support of British and American financial houses, as well as of a small group of British manufacturers, and two important contracting firms. This railway will shorten the journey from Madrid to Valencia by many hours, and might make Valencia the principal port for Madrid. As, however, the whole matter is still *sub judice*, it is perhaps as well merely to add that the scheme in its entirety is probably the most important of its kind which has been brought up for many years, and if successfully carried out will go a long way towards improving the transport situation.

* H.M. Stationery Office. Price 2s.

Water-Power Development.

The most advertised piece of hydro-electric work in recent months has been the Alicante development. One half the power produced is applied to irrigation. The supplying company is the Sociedad Electrica de los Almadenes. On the whole, the Commercial Secretary considers that the development of hydro-electric power has been well maintained during the year, although its rate of progress falls far behind the country's requirements, enormously rich as it is in this potential energy. In the last twelve months some 80,000 h.p. has been added to the power available, which is now believed to amount to 800,000 h.p., calculated as one-tenth of the full capacity of the Peninsula. Electrified railways, tramway enterprises, new factories, lifts, and the many industries now being served by electric power easily absorb the whole production of energy, and the high cost of coal and freights makes the tendency to have recourse to hydro-electric power more and more marked.

Periods of short rainfall have, however, to be reckoned with, and the past year has been particularly dry. New commitments have therefore had to be greatly curtailed in some districts, as, for instance, Madrid. Here the various companies contracting for the supply of electrical energy have not been able to meet their engagements fully, and could not afford to make up any deficiency with steam-generated current owing to the high cost of coal. The Unión Eléctrica Madrileña hopes soon to derive a further 14,000 h.p., from the new generating station at the mouth of the Jucar, on which 30 to 35 million pesetas have been spent, when the company will dispose of a total of 34,000 h.p. The Hydro-Eléctrica Española, which produces power for the Co-operativa, has failed to reach the figure (12,000 h.p.) contracted for, and although the Dos Aguas waterfalls have now been harnessed, as the Molinar and De Villora lines have not sufficient carrying power, the current will be used to supply Valencia, Cartagena, Alcoy, and Sagunto, instead of a new line being built at a cost of 15 millions of pesetas. Falls nearer to Madrid will have to be turned to account, and another 150,000 or 200,000 h.p. should be available within 60 km. of the capital. Several important new concessions have been granted in this connection.

The only new company of importance reported to have been constituted for the building of hydro-electric works is "Saltos del Rio Ondarroa," whose offices are at Gemein (Vizcaya), and which was formed with a capital of 1,455,500 pesetas. The Hydro-Eléctrica Ibérica has progressed considerably with its installation on the Saltos del Cinca and the Cinqueta (Argón); the Productora de Fuerzas Motrices is erecting machinery on the Salto de Agua de Cledes (Lérida) for the production of 16,000 h.p.; the Catalana de Gas y Electricidad is constructing a 20,000-h.p. plant on the Argone falls; and the Co-operativa de Fluído Eléctrico de Barcelona, constituted in 1921 with a capital of 25 million pesetas, is already constructing lines capable of carrying 50,000 kW to feed Barcelona with power from the Segre, La Vansa, Cardoner y Agua de Vals Falls, which this company acquired from the Hydro-eléctrica del Cadi.

Throughout the report there are many useful observations on the subject of business methods to be adopted in Spain, selection of agents, need for extended credit, ways of overcoming Customs difficulties, and economising in warehouse charges. For these hints reference should be made to the report itself.

SOUTH-EAST LANCASHIRE ELECTRICITY ADVISORY BOARD.

INAUGURAL MEETING.

FOLLOWING the first statutory meeting of the South-East Lancashire Electricity Advisory Board—the proceedings of which were private—a luncheon was held at the Midland Hotel, Manchester, on July 19th, when a company of about 100 sat down, comprising members of public bodies, directors of companies, electrical engineers, and other officials, having as their chairman Alderman Dagnall, and their principal guest Sir John Snell, representing the Electricity Commissioners.

After the toast of "His Majesty the Duke of Lancaster," Alderman Walker, in proposing "the Electricity Commissioners," remarked that it was fitting that the first meeting of the Advisory Board should have been held in Manchester, where so much had been done in the early stages of formation. They had to remember that it was only part of a great organisation, for above it was the controlling body—the Commissioners, the two working together in harmony, and with the same united aim, to the advantage of the country and the good of its people. It was only by acting in concert and with the public good always in view that those many conflicting interests could be reconciled with which this organised industry had to deal. Their good wishes went out to Sir John Snell and his colleagues on the Commission, whose good work all recognised, and to whom they all said from their hearts: "May God speed you in your labours."

SIR JOHN SNELL, in reply, said it had been a great pleasure to him to be present that day at the inauguration of the first Advisory Board under the new Electricity Acts. Alderman Walker had referred to the difficulties which confronted the Commissioners. Had he (Sir John) known what was before him when he was asked by the Government to take up the position he would have refused the proposal. It was astonishing to think, remembering the comparative youth of the industry, how complex and difficult were the matters with which the Commissioners were called upon to deal. It was no easy thing to provide machinery which would meet the various authorities, extending over a large district, and reconcile their rights and obligations in such a way as to secure a sound working organisation. If the boards had started *de novo* this trouble would not have arisen. As it was, they had to deal with existing powers wielded by public authorities and companies working under various Acts of Parliament and having authority under different Orders; and in order to bring about co-operation and co-ordination between them somebody had to give way or it would be impossible to consolidate them into a good working scheme capable of being administered in the public interest and designed for the benefit of the community as a whole. Thanks to the labours of the original committee, the task of the Commissioners in the settlement of proper districts had been made comparatively easy. All the local authorities and public companies in that important district of South-East Lancashire had met together and said: "We don't want a Joint Authority; we want an Advisory Board, and we will pull together if you, the Commissioners, will invest us with the necessary machinery and get that machinery to work." That representation came with such unanimity that the Commissioners saw at once what was the right thing to do. Now the district had a newly-constituted Board—it had got to work, it had got a scheme started. But he wanted to point to a problem where it was not only a question of local authorities and power companies lying down together, but where they had the London County Council—to which Parliament had granted the right to purchase company undertakings—where they had a vast number of local authorities, five other county councils, and important companies involved, with millions of money invested. Then it could be seen what complications and troubles became the lot of the unfortunate Commissioners. Parallel actions could only be taken two at a time, two Commissioners having to deal with one problem and two with another, while the odd man was doing nothing. Let them remember that what used to be done by the Board of Trade was now undertaken by the Commissioners. All the details of a scheme underwent the most careful scrutiny. Sometimes their friends outside said by way of lamentation: "We applied to you months ago for leave to borrow £5,000. When are we to get a decision?" Let these impatient ones bear in mind what the Commissioners had to do. In the course of three years they had dealt with something like 1,500 applications for loans, so that his friends outside need not think the Commissioners were not capable of that expedition which, as business men, they would like to see regarding any particular application in which they were interested. He believed that with the goodwill of the electrical engineers and the hearty co-operation of administrators (chairmen of committees, members of committees, and chairmen of companies) the Commissioners would be able to bring about a revolution—or should he say an evolution?—in the development of the electricity supplies of this country. There were signs of it already. Had they seen what was taking place in other countries? Unless they put their hands to the plough and did not look back, unless they made a great effort in this industry, they would not be doing their duty in helping to meet the growing competition from nations overseas.

Alderman HIGHAM, introducing the toast of "The South-East Lancashire Advisory Board," congratulated that body on the successful solution of all difficulties and in having presented a magnificent scheme, which would operate within an area containing one-tenth of the whole population of England, with one-tenth of the entire rateable value of the country, and one-tenth of the whole electrical plant, besides ministering to the wants of 100 authorities of one kind and another.

The CHAIRMAN (Alderman Dagnall), responding, said the Board had got into a state of harmony which augured well for the future.

Alderman A. E. BAUCHER gave "the Engineering Advisory Committee," and said it was as fine a body of engineers as could be found in the country.

Mr. S. L. PEARCE, C.B.E., responding as Chairman of the Committee, claimed that they had set up machinery which would bring about a unified system of control. In Mr. Banks, their clerk, they possessed a gentleman of very great energy and no ordinary initiatory power.

THE LIGHTING OF MESSRS. J. LYONS AND CO.'S "CORNER HOUSE."

The General Electric Co., Ltd., has sent us the following particulars of the lighting installation at the recently-opened "Corner House" restaurant, Coventry Street, W. The building itself is an excellent addition to London's buildings, and the decoration of the interior has been carried out in a lavish but artistic manner.

The ground floor is a handsome apartment, decorated in Louis XIV style, and the electroliers are well in keeping with the decorations. Twenty-one electroliers were supplied for this floor and, in common with the other fittings described in this article, were specially designed for this building by the G.E.C. in collaboration with Messrs. J. Lyons & Co., Ltd. The electroliers are of heavy cast brass, finished French ormolu, and are designed in strict accordance with the traditions of the period. They are equipped with satin finish and cut-glass panels, rich cut glass bowls and fiddle-back lustres. Fifteen of the electroliers are 36 in. in diameter, the remainder being 27 in. in diameter. On this floor there are also 22 two-light and three-light brackets to match the electroliers.

The first floor is designed in the Empire style, and is lighted by fifteen electroliers specially-designed to fit in with their surroundings. They are of heavy cast brass, finished French ormolu, with satin finish and cut glass. Fifteen three-light brackets to match are also installed.

Fig. 1 illustrates the electrolier designed in Adam style for the second floor. Fifteen such fittings of heavy cast brass were supplied together with 10 two-light brackets to match.

The staircases are lighted by 29 two-light brackets in rich French style and 24 bowl pendants of similar character suspended from the ceiling. A number of special brackets were also supplied for mounting over the doorways, these being of various patterns in conformity with the styles of their respective floors.

One of the most attractive portions of the lighting installation of the building is the exterior illumination shown in fig. 2, which is carried out by a number of G.E.C. floodlights installed upon the opposite side of the road. The equipment

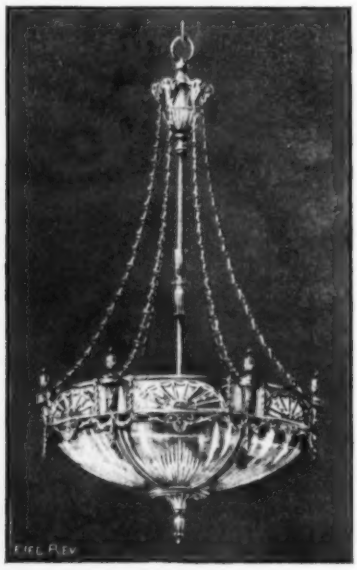


Fig. 1.—Adam Style Electrolier at the "Corner House."

consists of 25 floodlights each containing a 500-watt "Osram" gasfilled lamp. They are arranged in banks on the first floor of the building opposite, and are so focused as to obtain an approximately even illumination on the face of the "Corner House." There have been many notable attempts in the past year or so to floodlight buildings in this country, but in practically every case the installation has had to be mounted on the building in question, thus considerably restricting the possibilities of this method of lighting. The system adopted at the "Corner House," however, is not subject to these restrictions. The restaurant is a most conspicuous building at night, and is well worth a visit of inspection.

It may be mentioned that in addition to supplying the electric light fittings described, the G.E.C. is well represented in other portions of the installation, amongst other electrical material supplied being the whole of the wires and cables used. This is the company's "Alpha" 2,500-megohm Association grade cable. Further, the building is lighted throughout by over 4,000 "Osram" gasfilled and vacuum lamps.

Fig. 2.—The Flood-lighted Exterior of the "Corner House."

We are indebted to Messrs. J. Lyons & Co., Ltd., for permission to reproduce these particulars and illustrations.

CARGO HANDLING AT PORTS: BRITISH AND AMERICAN METHODS COMPARED.*

By BRYSSON CUNNINGHAM, D.Sc. (*Abstract.*)

In considering the factors which influence the design and lay-out of ports there is one important natural agency which affects Great Britain to a greater extent than America. In this country the waters of our principal ports are characterised by very pronounced variations of level at different hours of the day, amounting generally to between 20 and 40 ft. These ports are, therefore, confronted with the necessity of providing and maintaining artificially impounded areas of water within which shipping can be accommodated. In other words, dock systems are more or less a necessity on the seaboard of the British Isles, although some ports, *e.g.*, Glasgow and Southampton, are favoured with a tidal range which is not so extreme as to demand docks, with their troublesome and expensive appanages of locks and operating machinery. On the other side of the Atlantic, although there are a few exceptions, the general rule is the other way. Consequently, it will be found that the berthage for shipping at most American ports consists almost entirely of piers and jetties. But the influence of the tides does not cease here, it extends also to the working and functioning of the port appliances. The principal disturbing element is the tidal range. Where this is at all considerable, the difference in level of a ship's deck and the quay may at times render the use of the ship's gear impracticable. In docks other considerations enter into account, and commend the use of quay cranes. In American ports "Burtoning" is resorted to. This is a system which involves the erection of a longitudinal girder or rail along the quay front to which pulleys may be fixed and employed in conjunction with winches; it is a system, however, that is not considered entirely satisfactory.

The quay crane at English ports has been brought to a high pitch of development. It is nearly always fitted with a luffing movement which enables the jib to move in and out in a straight line, as well as a sluing movement. The luffing gear in modern cranes is accompanied by a compensating gear, which obviates any needless raising of the load during

* Paper read at the Institute of Transport Congress, Sheffield.

the movement, thereby economising in power consumption. A number of electrically-driven cranes possessing these characteristics have been installed by the Port of London Authority at the King George V Dock. The maximum load capacity of these is three tons, which can be lifted at any radius from 20 to 60 ft. The jib may also be luffed out to 65 ft. at which radius lower loads, up to two tons, may be lifted. On the north side of the dock, where there are no jetties and the sheds are double-storey structures, similar cranes can land goods on any part of the quay, and also on the balcony of the upper shed floor. On the latter is an installation of underhung electric cranes. The Mersey Docks & Harbour Board is erecting treble-storey sheds at the Gladstone Dock, Liverpool. The quays are to be served by 3-ton cranes and, in addition, there will be roof cranes on the shed at the roadside. At the King George Dock, Hull, the structures are single-storied, and are equipped with 3-ton quay cranes and 30-cwt. roof cranes.

As regards trucking the cargo in and through the sheds, the principal appliance at American Atlantic ports is the mechanically-propelled tractor with a train of trailers. In British ports the runs are generally shorter, and a self-contained vehicle is favoured; hence the almost universal use of the electric truck, generally of one or two tons capacity.

Turning to conveyors, a good example is that at Tilbury Docks specially designed for the handling of tea in wooden chests. The chests are taken up from the hold to the deck by an elevator and placed on an electrically-driven belt conveyor for conveyance to the shed. Upon reaching the shed they pass to a couple of inclined belt conveyors driven by electric motors by which they are raised to a height of 10 ft. They then travel to their stacking points by means of gravity conveyors. With this equipment 6,000 chests can be dealt with in an eight-hour day.

The typical means of coal handling at ports in Great Britain are the coal hoist and the coaling crane, but in America the belt conveying system, of which there are, of course, several examples at British ports, is being rapidly developed in competition with the direct tip.

The paper concludes with a reference to grain-handling which is accomplished chiefly by belt-conveyors and bucket elevators.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Hush-a-Phone."

Our attention has been drawn to a simple device for attachment to an ordinary telephone instrument by means of which absolute privacy of conversation can be ensured, and the annoyance caused in busy offices eliminated. This is the "Hush-a-Phone," a box-like fitting shaped to fit round the mouth, and containing sound-absorbing devices. The volume of the box is sufficient to permit the voice to expand, and all sound waves not essential to transmission are said to be absorbed. The appliance is of American origin, and it is being sold in this country by the BRITISH HUSH-A-PHONE CO., 19, Berkeley Street, W.1. An illustration of the device fitted to a desk instrument appears herewith (fig. 1).

A New Type of Headphone.

Fig. 3 illustrates the Brookes (patent) "Unison" headphones made by the ART METAL STAMPING CO., 58 & 59, Graham Street, Birmingham. The principal innovation is the method of reducing the pressure upon the head and ears. This is accomplished by a pair of pneumatic soft rubber grips fixed to an oxidised copper band. The earpieces are held in stirrups with a sliding extension piece. The latter is held in position away from the headband by a light spring. The telephones themselves are wound for 4,000 ohms the pair, and are provided with carefully "aged" tungsten-steel magnets.

The "Universal" Bench Light.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2, has recently evolved the "Universal" bench light, a device which is, it is claimed, a great improvement on anything of its kind now in use, and is especially suitable for the illumination of machines that are employed in groups on benches, as in boot and clothing factories where the eyes of the machinist are of necessity fixed on one spot, and where the closeness of the work requires powerful but glareless illumination.

The light (fig. 2) performs practically a triple function—first, the illumination of the working points at high intensity; secondly, the illumination of the bench at medium intensity; and thirdly, the general illumination of the room at low intensity. The fitting consists of two essential portions, the body, containing a lampholder and furnished with four condensing lenses spaced radially round the lamp, mounted on an adjustable support or stem intended for attachment to the top of the bench; and an over-reflector, fixed on the top and slightly above the body, diffusing the upward light over the bench and having a central opening fitted with diffusing glass for the general illumination of the apartment.

The body consists of an aluminium spinning with an all-porcelain lampholder mounted on a central tube (an extension of the stem) and having four openings placed in pairs diametrically opposite one another. Each of these openings is provided with an adjustable housing carrying a condensing lens and diffusing glass at such a distance from the lamp that the lamp filament (occupying a central position) is focused by the lens, and a powerful beam of light consequently projected therefrom. Universal adjustment (to a limited degree) permits of the direction of the beam being altered to some extent. The stem, which is rigidly attached to this body, passes through a base-plate (for attachment to the bench), and is capable of vertical and rotary adjustment therein. Four stalks attached to the body support the over-reflector, so that it is carried in such a position that the upward light from the lamp can pass up, and is then reflected down by the reflector without the lamp itself being visible from normal positions. As already mentioned, a diffusing glass is fixed in an opening in the centre of this reflector, which permits a small amount of the light from the lamp to pass directly upwards to illuminate the ceiling or roof of the room. When the fitting is fixed in its correct position, four concentrated beams of light are obtained, one of which may be directed to the working point of each of four machines. By this means a high intensity of light (in the neighbourhood of 60 foot-candles) is projected on the working points of these machines.

FIG. 1.—THE "HUSH-A-PHONE."

FIG. 2.—"UNIVERSAL" BENCH LIGHT.

FIG. 3.—THE "UNISON" HEADPHONES.

while at the same time the bench is generally illuminated, all from a single lamp.

This device is at present made in one size only, suitable for the 100-W "Mazda" projector-type lamp. The standard finish is grey enamel, with the reflecting parts white and the small parts nickel plated.

The "Santon" Electric Geyser.

The method of heating water adopted in the "Santon" electric geyser, made by SANTON, LTD., 34, Bridge Street, Newport (Mon.), is the one known to give the greatest efficiency obtainable, being almost 100 per cent. Leakage of current to earth through the water has been overcome in the geyser by

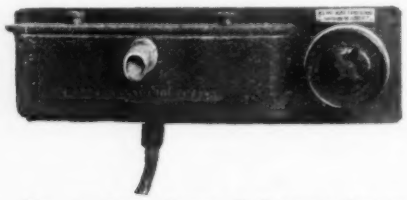


FIG. 4.—THE "SANTON" ELECTRIC GEYSER.

providing a body of insulating material, containing channels through which the water passes, forcing the water to take a path of comparatively great length and small sectional area. These channels being interposed between the actual resistance element and the earthed parts offer a very high ohmic resistance, thus making it a suitable apparatus for connection to any electricity supply system.

The geyser (which is illustrated in fig. 4) presents a very attractive appearance, being made of black insulating material, having an aluminium spout, which is provided at the back of the apparatus with a terminal for connection to earth, and when so connected there is not the slightest possibility of shock. In the event of the earth wire being carelessly left off, only a very slight shock is felt owing to the water channel resistance. The design gives a very long life to the heating element by rendering electrolysis practically non-existent. In use any scale which forms on the element cracks off when the coating is complete, and is easily washed away. In the event of a new element being required, it can be fixed in three minutes by anyone capable of using a small screwdriver. The ability to change the rubber inlet pipe from the "hot" to the "cold" tap presents many advantages, one of which is that the water in the storage tank can be "boosted" up for a bath, thereby minimising the consumption of current considerably.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

17,587. "Electric gasfilled discharge tubes." General Electric Co., Ltd. July 6th. (Germany, January 31st.)
17,589. "Sound-amplifying horns." F. E. Burt. July 6th.
17,596. "Electric switches." M. Gerschler and Signalapparatefabrik J. Kräcker Akt. Ges. July 6th.
17,605. "Junctions between coil boxes and cables." Felten & Guilleaume Carlswerk Akt. Ges. July 6th. (Germany, July 6th, 1922.)
17,608. "Telephone, &c., earpiece." P. V. Summer. July 6th.
17,611. "Trumpets of sound-reproducing apparatus." C. Hering. July 6th.
17,612. "Sound reproducers." C. Hering. July 6th.
17,613. "Trumpets of sound-reproducing apparatus." C. Hering. July 6th.
17,617. "Variable tuner for wireless waves." J. P. Garnell. July 7th.
17,625. "Telephone receivers." A. Marr. July 7th.
17,638. "Electric generators for electric welding." Macfarlane Engineering Co., Ltd., J. C. Macfarlane, and W. A. Macfarlane. July 7th.
17,659. "Sound-reproducing instruments." S. C. H. Roberts. July 7th.
17,664. "Wireless telegraphy, &c." G. F. Nicholson. July 7th.
17,678. "Sparking plugs." B. Hopps and A. M. Lodge. July 7th.
17,683. "Miners' electric lamps." A. Abell, J. Davis & Son (Derby), Ltd., and I. S. Mackenzie. July 7th.
17,692. "Sparking plug." F. S. Bassoli and E. Mari. July 7th.
17,710. "Thermionic valves." C. W. Clarabut. July 9th.
17,718. "Electrolytic electricity meters." Schott & Gen. July 9th. (Germany, August 7th, 1922.)
17,727. "Coating cores." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 9th.
17,732. "Electric circuit-breakers, &c." E. B. Wedmore and W. B. Whitney. July 9th.
17,735. "Electric batteries." E. X. Mazo and A. J. B. Tauleigne. July 9th.
17,738. "Self-charging electric vehicles." H. G. C. Fairweather (Arendt and Morton). July 9th.
17,741. "Radio receiving circuits." W. B. Medlam and U. A. Oschwald. July 9th.
17,746. "Radio communication apparatus." M. A. Renison. July 9th.
17,748. "Short-circuited rotors for asynchronous electric motors." J. Rzelman. July 9th.
17,781. "Control of voltage, &c., in electrical systems." British Lighting and Ignition Co., Ltd., and E. O. Turner. July 9th.
17,788. "Vacuum tube and system." Connecticut Telephone & Electric Co., Inc. July 9th. (United States, August 5th, 1922.)
17,791. "Loud-speaking telephonic apparatus." E. A. Graham. July 9th.
17,804. "Telephone receiver holder." Office Equipment Co., and H. W. Thompson. July 10th.
17,809. "Controlling highly-induced electric currents." W. E. Box, A. E. Davies, and H. H. Thompson. July 10th.
17,815. "Connections between electrical conduits and their boxes." J. Tucker. July 10th.
17,835. "Electric switches." H. J. Norballe. July 10th.
17,846. "Illuminated electric signs." H. G. Detheridge. July 10th.
17,862. "Electric lamp fittings." J. Stone & Co., Ltd., and J. F. Vidal. July 10th.
17,872. "Electric indicating devices for motor vehicles, &c." British Thomson-Houston Co., Ltd., L. Griffiths, and A. P. Young. July 10th.
17,877. "Electric signs for exhibiting reading matter." J. P. Bodg... July 10th.
17,890. "Sparking plugs." H. Z. White. July 10th.
17,907. "Electric switches." L. E. A. Bourn. July 11th.
17,908. "Local distribution of signals from wireless receiving apparatus." L. E. A. Bourn. July 11th.
17,918. "Variable high resistance." C. E. Vawter. July 11th. (United States, July 12th, 1922.)
17,965. "Electric ignition apparatus for internal-combustion engines." J. ... Waller. July 11th.
17,971. "Reaction coils for wireless receiving sets." A. E. Bowyer-Lowe. July 11th.
17,976. "Means for generating oscillations of high frequency." C. ... Franklin. July 11th.
17,988. "Wireless telephony." W. H. Brown and C. W. Goyder. July 11th.
17,990. "Secondary cells for miners' electric lamps." A. Abell, J. Davis and Son (Derby), Ltd., and I. S. Mackenzie. July 11th.
17,997. "Chains for electroliers, &c." R. A. Griffiths. July 11th.
17,999. "Automatic telephone systems." Aktieselskab Elektrisk Bureau. July 11th. (Norway, July 18th, 1922.)
18,002. "Loud-speaking telephones." E. A. Graham. July 11th.
18,004. "Circuit-breakers for magnetos." Soc. des Moteurs Salmson (Système Canton-Unné). July 11th. (France, July 26th, 1922.)
18,009. "Preparation of ductile wire of tungsten, &c." General Electric Co., Ltd. July 11th. (Germany, December 23rd, 1922.)
18,014. "Thermionic valves, &c." N. Lea and Radio Communication Co., Ltd. July 12th.
18,024. "Electric circuit terminals or connections." J. E. Boxall. July 12th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

35,101. "Alternating-current motor groups." Forges et Ateliers de Constructions Electriques de Jeumont. January 26th, 1921. (174,583.)

1922.

5,676. "Headlights for motor and other vehicles." W. Birtwisle. February 27th, 1922. (199,762.)
5,815. "Oil switches and fused switches." E. Dobson. February 27th, 1922. (199,767.)
6,363. "Dynamo-electric machines." Sir C. A. Parsons and J. Rose... March 3rd, 1922. (Cognate application, 11,732/22.) (199,772.)
8,540. "Method of constructing an electric accumulator." A. H. Cull... and L. Mott. March 24th, 1922. (199,785.)
8,591. "Means for preventing oxidation of electrical conductors and the like." L. J. Hancock and T. R. Hancock. March 24th, 1922. (199,787.)
8,646. "Electric insulators." W. H. Eccles. March 25th, 1922. (199,78...
8,794. "Burglar alarm." G. C. Robey. March 27th, 1922. (199,792.)
8,915. "Electrically-driven gramophone tables." C. A. Youldon. March 28th, 1922. (199,803.)
9,083. "Electric spark-gap apparatus." H. Kennedy & Co., and P. Dave... March 29th, 1922. (199,816.)
9,210. "Mounting of electrodes or electric discharge points in the hull of ships and submerged structures." James Anti-fouling Appliances, Ltd., J. B. Wilkie, and H. Neville. March 30th, 1922. (199,824.)
9,302. "Automatic selectors for automatic telephone systems and the like." G. Alfani and L. Mazza. April 1st, 1921. (177,799.)
9,311. "Alternating current electrical instruments." G. F. Shotter and E. W. Hill. March 31st, 1922. (199,826.)
9,333. "Electric transmission for vehicles." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 31st, 1922. (199,830.)
9,350. "X-ray tubes." A. C. Goolden, V. E. Pullin, and A. G. Warren. March 31st, 1922. (199,831.)
9,464. "Measurement of high electrical resistances or ionisation strengths." S. Strauss and W. Brandt. April 2nd, 1921. (177,808.)
9,527. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). April 3rd, 1922. (199,839.)
9,569. "High-speed dynamo-electric machines." Soc. Anon. Pour L'Exploitation des Procédés M. Leblanc-Vickers. April 16th, 1921. (178,429.)
9,900. "Means for the selective reception of alternating currents." F. ... Pernot and L. J. Rich. April 7th, 1922. (199,848.)
11,727. "Induction coils." British Lighting and Ignition Co., Ltd., and E. O. Turner. April 26th, 1922. (199,879.)
11,973. "Adjustable reflector for lamps." Aktiebolaget Separator. April 29th, 1921. (179,187.)
12,347. "Electrical controllers for lighting circuits." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). May 2nd, 1922. (199,887.)
13,382. "Generation of alternating currents by thermionic devices." E. ... Robinson. May 12th, 1922. (199,894.)
13,394. "Movable supports for electric light, gas, and other purposes." J. Dugdill. May 12th, 1922. (199,895.)
13,595. "System for regulating the voltage of a dynamo at varying speeds." G. Fornaca. May 15th, 1922. (199,898.)
13,603. "Primary cells." V. E. Richards. May 15th, 1922. (199,899.)
13,670. "Electromagnetic motors." H. Mace. May 15th, 1922. (199,9...
19,560. "Method of and means for generating and amplifying electric oscillations by thermionic tubes." L. G. Preston and N. Shuttleworth. ... 17th, 1922. (199,964.)
19,925. "Electric water-heater." F. L. Newhouse, C. H. Smith, ... Electric Fires, Ltd. July 20th, 1922. (199,967.)
20,471. "Regulating devices for high-intensity arc lamps having extreme rapid ignition." H. L. M. J. Bénard. July 26th, 1922. (199,969.)
20,933. "Shades for incandescent electric lamps." Soc. Industrielle ... Appareils Economiques. August 6th, 1921. (184,183.)
21,826. "Electric arc gap terminal arrangements or installations." ... Manufacturing Co. April 7th, 1922. (195,925.)
24,061. "Electric switches." O. Lucas and F. Handley. September ... 1922. (199,989.)
26,370. "Loud-speaking telephones." Automatic Telephone Manufacturing Co., Ltd., S. R. Smith, and P. N. Roseby. September 29th, 1922. (199,...
29,033. "Coil-holders for wireless apparatus." H. Saville and C. ... Thornton. October 25th, 1922. (200,015.)
34,634. "Process for the deposition of metals by electrolysis." P. ... Govaerts and P. M. Wenmaekers. December 19th, 1921. (190,500.)

1923.

2,291. "Gas-filled discharge tubes." Naamlooze Vennootschap ... Gloeilampenfabrieken. February 15th, 1922. (193,384.)
13,408. "Electric switches." E. Dobson. February 27th, 1922. (... application on 199,767.) (200,044.)